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VOLUME IV

-W. R. Grace and Company-

○

Railroad Plan

ENVIRONMENTAL IMPACT STATEMENT

NORTHWEST COLORADO COAL

U.S. DEPARTMENT OF THE INTERIOR

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PREFACE

This is Volume IV of the Northwest Colorado Coal Environmental Impact Statement. Contained herein is the environmental analysis of W. R. Grace and Company's proposal to construct a railroad. Although this analysis is intended to stand alone, some reference is made to the Regional Analysis found in Volume I. All impacts of W. R. Grace and Company's proposal are assessed over and above the future environment without the proposed action as presented in Chapter IV of the Regional Analysis.

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W. R. GRACE RAILROAD

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Chapter I

Description of the Proposed Action

THIS CHAPTER IS A DETAILED DESCRIPTION OF W. R. GRACE AND COMPANY'S PROPOSAL TO CONSTRUCT A RAILROAD FROM CRAIG, COLORADO TO AXIAL BASIN. THE CHAPTER IS DEVELOPED BY DESCRIBING THE STAGES OF IMPLEMENTATION OF THE COMPANY'S PROPOSAL. THE FEDERAL ACTIONS THAT WOULD BE REQUIRED ARE ALSO DISCUSSED IN THIS CHAPTER.

CHAPTER I

DESCRIPTION OF THE PROPOSED ACTION

The Applicant's Proposal

Background and History

On April 30, 1975 W. R. Grace and Company filed a tramroad right-of-way application with the Colorado State Office of the Bureau of Land Management for construction of a railroad between Craig and Axial, Colorado. The application was given serial number C-22673 and was filed under the provisions of the act of January 21, 1895 (28 Stat. 635; U.S.C. 956), which authorized the Secretary of the Interior to permit the use of tramroads on public lands by any citizen or association of citizens of the United States engaged in the business of, among other things, mining. Tramroads, as defined in the act, include railroads used in connection with mining. The maximum right-of-way width provided by the Act is 100 feet.

Two phases of the railroad proposal will be considered in this Impact Statement: construction and operation.

The construction phase would consist of an intensive program for the development of the railroad line and pertinent facilities. This would include route selection, staking design, engineering, obtaining rights-of-way, construction of railroad bed, bridges, drainage structures, fences, etc.

The operation phase would involve those facilities required for the heavy transportation schedule of coal by unit train. Operations would include long-term maintenance and additional construction necessary for expanding functions of the railroad.

Purpose of Proposed Project

The purpose of the proposed railroad would be to transport low sulfur subbituminous coal from a planned surface mine immediately south of Axial Basin in northwestern Colorado to the Denver and Rio Grande Western (D&RGW) Railroad near Craig. The existing railroad is already a major transportation means for coal being shipped east from northwestern Colorado.

General Description of Proposed Route

A feasibility study of three routes was conducted for the applicant by Morrison-Knudsen Company, Inc. These routes are depicted on Figure GRI-1 as A, B, and C. The route preferred by the applicant is A; it is considered the proposed route in this report.

The route would join the proposed Colorado-Ute spur approximately four miles from the terminus of the existing D&RGW Railroad at Craig. At the approximate starting point of the spur's loop into the plant site, the route would extend westward along a ridge parallel to the loop, and then southwestward on a high fill, crossing over State Highway 13 via a steel girder bridge where Johnson Creek and the highway intersect. Dropping on a maximum grade of 0.8 percent, the route would parallel Highway 13 from MP A-1 to A-3, then flatten to a level grade and follow a bluff along the south side of Yampa River to the confluence of Yampa and Williams Fork Rivers (A-4.3), where a steel bridge would be required across the Williams Fork. From the Williams Fork bridge, the route would continue at an elevation of 6,130 feet along the south side of the Yampa to Milk Creek (A-13.8), which would be crossed by another steel bridge.

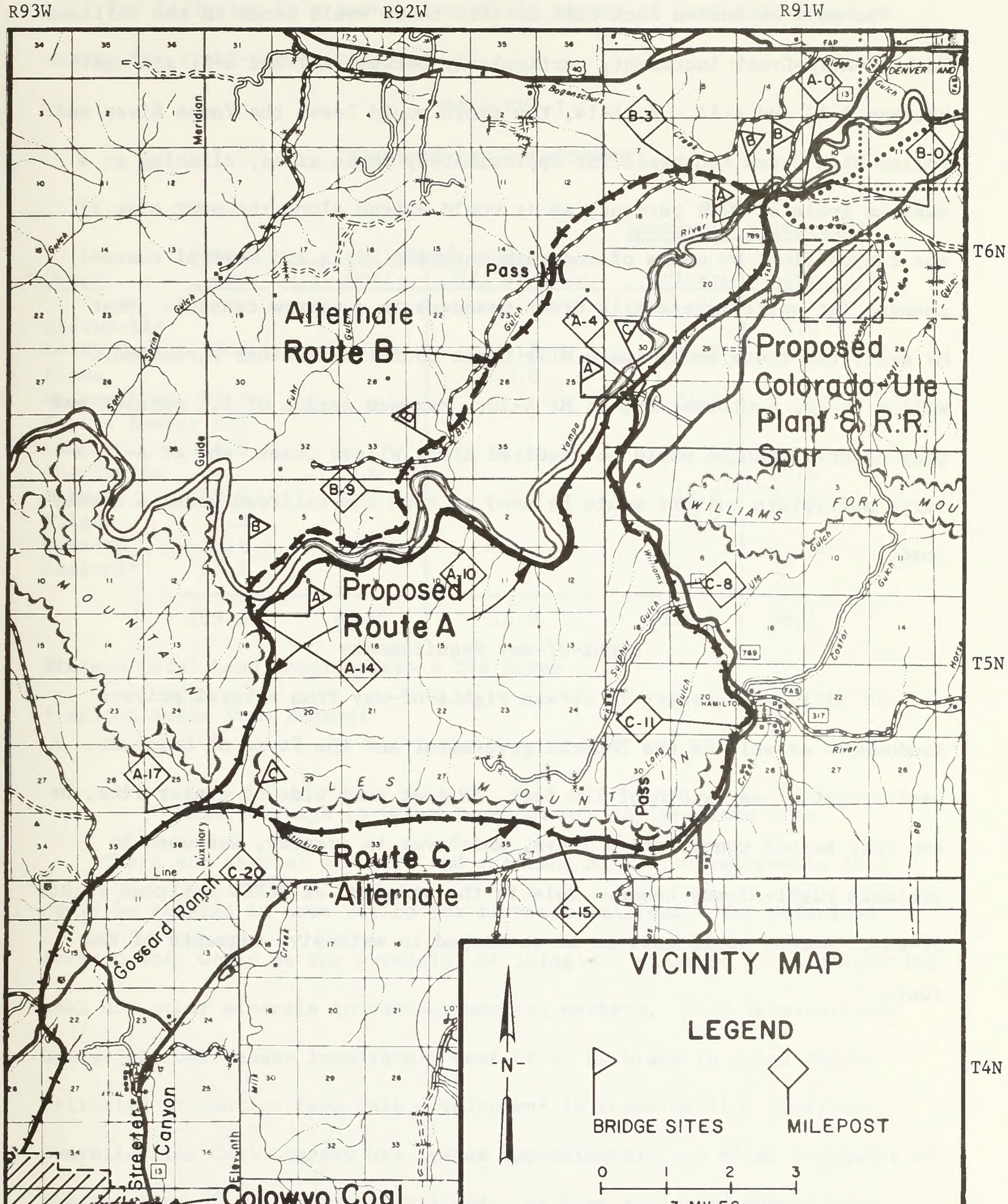


FIGURE GRI-1

Proposed and alternate routes, W.R.Grace railroad.

The most extensive rock cuts on this route would occur in the Williams Fork-to-Milk-Creek increment, particularly between A-7 and A-8, and again between A-13 and A-14. At A-14, the route would leave the Yampa River and follow Milk Creek southward for approximately three miles, climbing at a maximum grade of 0.91 percent, as it would extend along the west side of the canyon floor by means of moderate cuts and fills and several channel changes (at points where Milk Creek meanders in a narrow canyon). Near MP A-17, the route would leave Milk Creek to follow another streambed, Wilson Creek, southwestward to MP A-20. Maximum grades of 1.1 percent and many channel changes would be required along Wilson Creek, and at A-20 a large multiplate culvert would be used to take the railroad under a county road.

Right-of-way Requirements

It will be necessary to obtain rights-of-way from several private landowners as well as the Federal government and the State of Colorado. A basic right-of-way width of 100 feet, 50 feet each side of center line, or ten feet beyond construction lines, whichever is greater, was used to estimate right-of-way needs. This is the standard of D&RGW Railroad right-of-way. Access would have to be developed to extensive segments of the route.

The following is a tabulation of the amount of land that would be needed for right-of-way purposes.

TABLE GRI-1

Right-of-way Requirements

Owner	Deeded Land	Leased Land		Juniper Reservoir Withdrawal	
		U.S. Govt.	St. of Colo.	Private	Govt.
Raftopolis			5.0		5.0
Loudy	33.2		4.1	33.2	4.1
Evans			3.8		
Wilson Bros.	21.3			21.3	
Empire Energy	6.7				
Clancy	14.8				
Charchalis		29.6			29.6
Hilton	52.5	59.4		42.2	59.4
Ellgen	8.8			8.8	
Gossard	39.4				
Zamboni*	17.1			17.1	
	193.8	89.0	12.9	122.6	98.1

Minimum Total Land Requirements = 296 Acres

* Hilton lease from Zamboni

Relationships to Other Developments in Immediate Area

There are several proposed and existing mineral developments that could be related in some way to the proposed railroad. The principal relationship would be the potential of using the railroad for transporting coal and other minerals to various eastern markets. Utah International has major coal leases immediately west of W. R. Grace in Axial Basin; estimated production from this development is three million tons/year. Consolidation Coal Company has leases approximately ten miles southwest of the terminus of the proposed railroad. With an estimated annual production of nine million tons to be transported, an additional spur to the proposed railroad could be constructed, or coal could be hauled by truck to the terminus. Empire Energy has an underground coal mine within a mile of the railroad and could use it for transport.

If the railroad would someday be extended south to Meeker and the White River, it could be used by Superior Oil Company to haul nahcolite, dawsonite, and shale oil from their proposed development; annual production of these minerals is estimated at six million tons. An extension of the railroad could possibly serve the anticipated transportation needs of Colorado oil shale lease tracts (C-a and C-b) southeast of Rangely, and Utah oil shale lease tracts (U-a and U-b) west of Rangely.

Another relationship exists between the railroad and Juniper Dam, proposed to be built on Yampa River approximately 22 miles downstream from the confluence of Milk Creek and Yampa River. The reservoir created by the Bureau of Reclamation proposal would extend upstream to the Williams Fork River. With a proposed high water level of 6,110 feet, the reservoir would influence the railroad route between Williams Fork and Milk Creek. Assuming the dam would be constructed as proposed, the railroad could be designed without conflicting with the reservoir. Maximum water elevations of the proposed reservoir have been set at 6,110 feet mean sea level (MSL) at the dam and 6,130 feet MSL at the confluence of the Williams Fork and Yampa Rivers. These figures from the Bureau of Reclamation reflect the maximum flood stage (i.e., the delta effect). The route is designed to allow a ten-foot freeboard above the reservoir. If Juniper Dam is constructed as prepared, riprap would be required for embankment protection along portions of Yampa River; this protective measure would not be taken until dam construction is initiated. The Juniper project would also include a pumped-storage facility along the east bank of Yampa River. Further studies and correlation would have to be made with the Bureau of Reclamation to assure compatibility between the railroad and this facility.

Design Criteria

Alinement and grade

As with virtually any railroad, alinement and grade criteria for the rail link between the Colowyo Mine and the D&RGW Railroad spur would be a compromise between desirable and possible. Representatives of the D&RGW Railroad have indicated the following criteria for preliminary studies of a rail connection in this vicinity: maximum grade against loaded trains of 0.8 percent, maximum grade against empty trains of 1.1 percent, and maximum curvature of seven degrees. While such criteria are desirable for heavy unit train operations, it should be noted that the D&RGW Railroad between Craig and Denver does not meet these grade and alinement standards, particularly regarding maximum grades. Analysis indicates that motive power required for operation into Craig from the D&RGW Railroad main line could allow a technically feasible operation over a railroad with grades somewhat greater than those set forth by the D&RGW Railroad. Final design criteria would be reviewed in light of operation and maintenance studies.

Cuts and fills

Requirements for cuts and fills would be based upon a geological reconnaissance of the routes by Morrison-Knudsen in June, 1974. In general all fills would be estimated on the basis of a 1.5-1 slope. Cut slopes would vary depending upon materials encountered from 1.5-1 in common, to a maximum of 0.25-1 under the most favorable rock conditions. The basic width of the roadbed would be 24 feet at subgrade elevation. No provision has been made for a maintenance way parallel to the roadbed. A 12-foot-wide rock ditch would be used in all rock cuts and through cuts. In addition to catching sluff, the ditch would provide some area for snow storage and would be wide enough to accommodate maintenance vehicles. Channel changes shown on the plans, principally where the route passes through Milk Creek Canyon, would be sized to accommodate 50-year flood flows, and would be estimated on the basis of 1.5-1 slopes with riprap protecting the railroad embankment.

Track

In selecting materials for use in track construction, the general principle followed would be: the material should be sufficient for this service and should also be readily available from the D&RGW Railroad, for ease of maintenance and availability in the event replacement or repair would be necessary. Materials used for the estimate would include:

1. A 119-pound continuous welded rail. This would be the lightest rail that could be expected to approach the 30-year life of the project. It is not anticipated that the rail would have to be changed during the life of the project unless unusual conditions cause wear. Standard rail sections used on the D&RGW Railroad for branch and main line track are mainly 115 and 131-pound sections. Continuous welded rail would be selected to reduce maintenance cost, reduce wear on rolling stock, and extend rail life.

2. Tie plates would be CF&I section TP32, a 13x18 inch double-shoulder plate which has sufficient bearing area to reduce the anticipated loads to a level of stress that would give long and economic tie life.
3. Cut spikes of 5/8x6 inches, a size based on the size and service of the other track materials and traffic to which the track would be subjected.
4. Ties recommended are size 5x9 feet with fir on the curves and pine on the tangents. ("Size 5" tie is 9 inches wide by 7 inches thick). Ties would be compatible with ties used by D&RGW Railroad, thus providing ease of maintenance from available stocks. The American Railroad Engineering Association (AREA) recommends nine-foot ties for this type service which provides better stability for welded rails.
5. Number 10 turnouts with 16'-6" switches -- the standard of D&RGW Railroad and a type that would provide adequate service for train speeds planned for the coal-haul route.
6. Ballast material estimates would be based on AREA size: G-3 crushed gravel graded from 1-1/2" down to 1/8" with 41-75 percent crushed particles. This ballast could be provided from a pit located south of Craig. Ballast depth would be 20" and extend 8" beyond ties, except on the outside of curves greater than 2° where it would extend 12" beyond the ties. The unusual depth of the ballast would preclude the need of sub-ballast except in special cases.

Structures

All bridges would be open deck steel structures designed for E-80 loading. No subsurface investigations have been made for foundations, but it is assumed that all foundations would require piles to obtain adequate bearing. Bridges lower than 25 feet would be H-beam pile bents and towers for substructure support. Bridges higher than 25 feet would use solid concrete shafts for the substructures. All abutments would be "sluff-through" types assuming a 1.5-1 slope for placement of the embankment. The weight of steel in various bridges would be estimated on the basis of similar structures.

For grade separations other than bridges, estimates would be based on a multiplate super-span type arch. At underpasses (railroad under other grade) the structures would be sized for a horizontal span of 26' 7" and a vertical rise of 28' 3". At the only overpass, across a county road on Route B, the structure would be sized for a horizontal span of 36 feet and a vertical rise of 21' 5".

Drainage

Drainage structures would be corrugated metal pipe of 30-inch minimum diameter. All pipes would be sized for 50-year flood conditions, and designed with a gauge thickness required for AREA E-80 loadings. Minimum spacing of cross-drainage would be 1,000 feet. For the protection of all embankments which encroach on flood-flow elevations, riprap would be estimated on the basis of two-foot thickness normal to the slope with an average rock size of 150 pounds.

Grade crossings

At-grade crossings would be proposed for all farm and ranch access roads as well as for several minor county roads. Access road crossings would require two cattle guards, planking, signs, and minor regrading of the road. County roads would be treated in a similar manner except adequate sight distance would be considered in each case.

Utilities, fencing, and miscellaneous appurtenances

Special measures would be taken for moving or protecting existing utilities in conflict with the proposed railroad.

Because the area south of Craig is used extensively for livestock grazing, right-of-way fences might be required. If fences were required, specifications would be used that offer the best compromise for the protection of livestock and wildlife on a case-by-case basis. Where adequate barriers would be created by cut slopes steeper than 1.5-1, no fencing should be necessary.

At the terminus of the railroad near the mine, load-out facilities would be necessary to load coal onto the railroad cars. As a minimum, the load-out facilities would be a tipple, conveyor system, dead storage area, live storage area, and possibly a silo. Although three possible terminus arrangements have been considered, the one preferred by W. R. Grace would involve construction of a siding for about 1-1/4 miles, in order to turn locomotives around. No other sidings would be planned.

No maintenance buildings or other buildings for the operation of the railroad would be required.

Construction Guidelines

Construction schedules

The railroad would require two seasons for construction. The normal construction season in the vicinity of Craig is seven months, beginning in mid-April and ending in mid-November; during this period construction generally can proceed without delays caused by weather. Earthwork and bridge building would begin simultaneously. In order to complete the project in two seasons it is essential that most of the grading be accomplished in the first construction season, and that bridges be ready so track laying can begin at the beginning of the second construction season. Bridge work might have to continue during the winter months in addition to the regular construction season.

Availability of materials

A check of current delivery schedules reveals that track materials require the longest lead time. Because of proximity, and to conform with D&RGW Railroad practice, the track materials probably would be purchased from the Colorado Fuel and Iron Works, Pueblo, Colorado. They would have to be delivered during the first construction season for welding. At the present time, suppliers are quoting a lead time of more than 18 months. With large expenditure planned for new railroads in the west it is doubtful if the delivery situation will improve in the next few years.

Special construction considerations

A temporary crossing might be necessary on Milk Creek to gain access and to work on either side. Final design of the railroad might show that it would be more economical to borrow in certain areas for fill, to reduce haul distances from other places along the right-of-way. If this were the case, additional use authorizations would be necessary for the borrow areas and access to them. Marshy areas, particularly at the mouth of the Williams Fork, might require special construction techniques. No access exists between Williams Fork and Milk Creek, a ten mile section. The impact of the steep bank along the Yampa River would require some special considerations in construction. Along the Yampa River and particularly in lower Milk Creek canyon, wildlife such as deer, grouse, and birds of prey would require special consideration to minimize impact of construction on their breeding activities.

Bridge construction

The following is a tabulation of the bridges and other structures that would be needed:

LOCATION 1	Sta 195 + 30 R.R. over State Highway 13
Length	200' on tangent
Spans	3 @ 23-1/3' 1 @ 60' 3 @ 23-1/3'
Skew	38° Height - 28'
Superstructure	Rolled beams on approach spans Plate girder on center span Wood tie open deck
Substructure	Steel pile piers
Cost of Structure	$187,500

LOCATION 2	Sta 381 + 50 R.R. over Williams Fork Stream
Length	104' on tangent
Spans	3 @ 34.7'

Skew	0° Height - 20'
Superstructure	Rolled beams Wood tie open deck
Substructure	Steel pile piers
Cost of Structure	$92,800
LOCATION 3	Sta 881 + 96 R.R. over Milk Creek 30' Channel
Length	200' on 7° curve
Spans	2 @ 34-1/2' 1 @ 62' 2 @ 34-1/2'
Skew	0° Height - 60' above stream
Superstructure	Rolled beams on approach spans Plate girder on center span Wood tie open deck
Substructure	Steel pile piers under approach spans Concrete tower on each end of center span
Cost of Structure	$352,800
LOCATION 4	Sta 1212 + 23 County Road over R.R.
Length	26' - 7" x 28' - 3" x 80'
Spans	Multi-plate super span
Cost of Structure	$32,600

Construction estimates

The estimate for earthwork would include handling of common and rippable materials by scrapers, and the handling of rock by drilling, blasting, front-end loading, and truck hauling. Hauls would be estimated for both the scraper and truck-transported materials. In some reaches, substantial quantities could be moved by dozers alone, sidecasting without loading into scrapers or trucks.

Significant production rates for equipment would be:

Drilling Air Track (4.57")	70-80 Linear feet/Hour
Scrapers (Cat 631)	85-90 Bank Cubic Yards/Hour
Trucks (R-35)	50-65 Bank Cubic Yards/Hour
Loaders (988)	150-200 Bank Cubic Yards/Hour
Dozers - Side Casting	200-350 Bank Cubic Yards/Hour

The following is a tabulation of construction estimates:

	Unit	Quantity
Clearing (based on 150' R/W)	Acres	394
Common excavation (incl. rock, borrow, emb. comp.)	Cubic Yards	1,521,700
Haul	Yard-Miles	669,600
Presplitting rock	Linear Feet	246,700
Riprap - in place	Cubic Yards	21,400
Pipe underpasses	Each	1
Relocate roads (incl. grading, drainage)	Miles	0.87
Grade crossings (incl. planking, grading, 2 cattle guards, signing)	Each	33
Fencing	Linear Feet	170,400
Revegetation (incl. seed, mulch, blowing)	Acres	55
Guard rail (for highway protection)	Linear Feet	4,500
Water for dust abatement	Million Gallons	900
Permanent RR materials	Total Feet	114,048
Ballast - in place	Total Feet	114,048
Track laying (incl. welding)	Total Feet	114,048
Turnouts	Each	2

Railroad operation and maintenance

Principal railroad use would be unit coal trains; they would consist of up to 92 railcars having a capacity of 100 tons per car. Usually the trains would be kept together as a unit and operated solely for the purpose of transporting coal from the mine to a specific destination. As many as five locomotives, each having 3,000 horsepower, might be needed. At maximum grades of 0.8 percent against load, the speed would be about 14-15 mph., and the average speed loaded would be about 30 mph.; top speed empty would be 50 mph. Fuel consumption of each engine is 140 gallons per hour in eighth notch, and 6-7 gallons per hour at idle. Obviously 140 gallons per hour fuel consumption is a maximum figure; the realistic average figure lies somewhere between this and 6 gallons per hour.

In order to run this private spur economically, the loading facility would be designed to accommodate loading of 10,000 tons of coal in two hours. Thus, one unit train per day of 92 cars could carry Grace's estimated three million tons of coal per year in about 326 days. A four-man crew would be necessary to operate such a unit train; occasionally a five-man crew (the fifth man being a fireman) would be on the train to comply with the union agreement calling for firemen on ten percent of all trains. For the first four or five years a section crew responsible for maintaining and repairing damage to the rails would consist of five members; thereafter the section crew would have to be enlarged to some unknown figure because more maintenance would be required for the older line. It is assumed these permanent personnel would be available locally.

Reclamation

Reclamation procedures would involve the establishment of a stable, self-perpetuating, vegetative cover on the lands disturbed by railroad construction. The majority of lands that would be affected now are covered with agricultural fields, sagebrush, greasewood, or some form of riparian vegetation.

Approximately 50 feet on each side of centerline would be disturbed, including cuts, fills, and graded slopes. Wherever practical, topsoil would be stored and replaced on any Lewis or Mancos shale that is disturbed, or on any areas that expose the "C" soil horizon or other strata unsuitable for plant growth, except for steep rock faces. It is doubtful that fertilizer would be required for this operation; however its usefulness would be evaluated during revegetation.

Seeding would occur as soon as practical after construction, and would be designed to coincide with optimum planting times, spring or fall. In some areas prone to erosion, winter wheat or another annual would be planted immediately for erosion control until the next optimum planting time when a comprehensive seeding mixture would be applied.

Hydromulching or a suitable substitute for seeding would be used on slopes steeper than 25 percent. A rangeland drill would be utilized for seeding surfaces that accommodate farm equipment. Depending on slope angles, a scarification procedure would prepare a seedbed suitable for plant growth where hard flat surfaces have been created during construction; steep surfaces of exposed rock would not be seeded.

Using the Soil Conservation Service's guidelines for revegetating disturbed areas, four seed mixtures listed below are recommended for the different ecological conditions that occur along the railroad route:

Recommendations for south facing slopes, steep topography, and/or low rainfall

Indian Ricegrass
Bluebunch wheatgrass
Streambank wheatgrass
Russian wildrye
Needle and thread grass
Sand dropseed
Western wheatgrass
Intermediate wheatgrass
Yellow sweetclover

Recommendations for moderate moist and cold location (east facing areas)

Smooth brome
Mountain brome
Hard fescue
Western wheatgrass
Orchard grass
Bluebunch wheatgrass
Slender wheatgrass
Yellow sweetclover

Recommendation for areas in the Axial Basin

Indian ricegrass
Bluebunch wheatgrass
Western wheatgrass
Siberian wheatgrass
Green needle grass
Sand dropseed
Streambank wheatgrass
Russian wildrye

Recommendations for Taylor Creek area

Timothy
Smooth brome
Big bluegrass
Orchard grass
Hard fescue
Western wheatgrass
Mountain brome
Bluebunch wheatgrass
Slender wheatgrass
Yellow sweetclover

Exact composition of species in each seeding mixture would depend on slope aspect, location, and degree. Each mixture would total approximately 25 pounds of seed per acre, including a fast germinating annual (such as winter wheat or oats) to provide early competition for weed species, enhance soil stability, and provide quick establishment of green cover. In areas of high wildlife and livestock use, unpalatable species in the seeding mixture would discourage stock and wildlife activity immediately adjacent to the railbed.

If various adverse climatic conditions cause failures, additional seeding would be required.

Other protective measures

Areas of the right-of-way that might be hazardous to wildlife or livestock, such as steep slopes or deep cuts, would be fenced. In areas where the landowner might request the right-of-way to be fenced to protect livestock, the fence would be designed to limit livestock but not hinder deer or antelope movements. A recommended design would be the following wire spacings, starting from the ground: 16, 6, 8, and 10 inches.

Railroad construction would be modified or stopped in spring during the periods when sandhill cranes would be nesting in the Big Bottom area. Sage grouse strutting grounds in the vicinity of the head of Milk Creek would be located prior to railroad construction and construction modified or stopped when grouse would be strutting. The timing of construction in the areas of sandhill crane and sage grouse activity would be coordinated with the Colorado Division of Wildlife (DOW).

Chapter II

Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH W. R. GRACE AND COMPANY PROPOSES TO CONSTRUCT A RAILROAD. ALTERATIONS OF THESE EXISTING VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE COMPANY'S PROPOSAL. ADDITIONAL EMPHASIS IS GIVEN TO A DESCRIPTION OF THOSE ENVIRONMENTAL COMPONENTS WHICH MAY BE IMPACTED BY THE PROPOSAL AND ALL REASONABLE ALTERNATIVES.

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

Non-living Components

Geologic and Geographic Setting

Topography

Geographic areas traversed by the proposed route of the railroad include gently rolling open country of the southern edge of the Sand Wash Basin southwest of Craig, the east-west mountain group of the Williams Fork Mountains and Iles and Duffy Mountains, and the east-west-trending rolling plains of Axial Basin. The southern terminus is at the northern edge of the Danforth Hills. Principal stream valleys involved are the Yampa and Williams Fork Rivers, and Bell Rock, Milk, and Wilson Creeks.

Altitudes in the general region range from just below 6,100 to above 7,500 feet. The Yampa River drops from about 6,170 feet at Craig to 6,065 feet at the mouth of Milk Creek.

The proposed route would begin at about 6,260 feet altitude on a bluff overlooking the Yampa River. It would continue south and southwest along the eastern bank of the river valley, dropping to 6,130 feet at the Williams Fork River junction. It then would continue west and southwest along the steep south side of the Yampa River valley at this same altitude for about 10 miles; here the Yampa is mostly confined to a narrow winding valley, with high steep slopes rising from the river's edge or from the edge of a very narrow valley floor (Figure GRII-1). Hills rise 400-700 feet above the river along this stretch with slope angles of 15-40 percent, increasing locally to 100 percent. After entering Milk Creek Canyon at

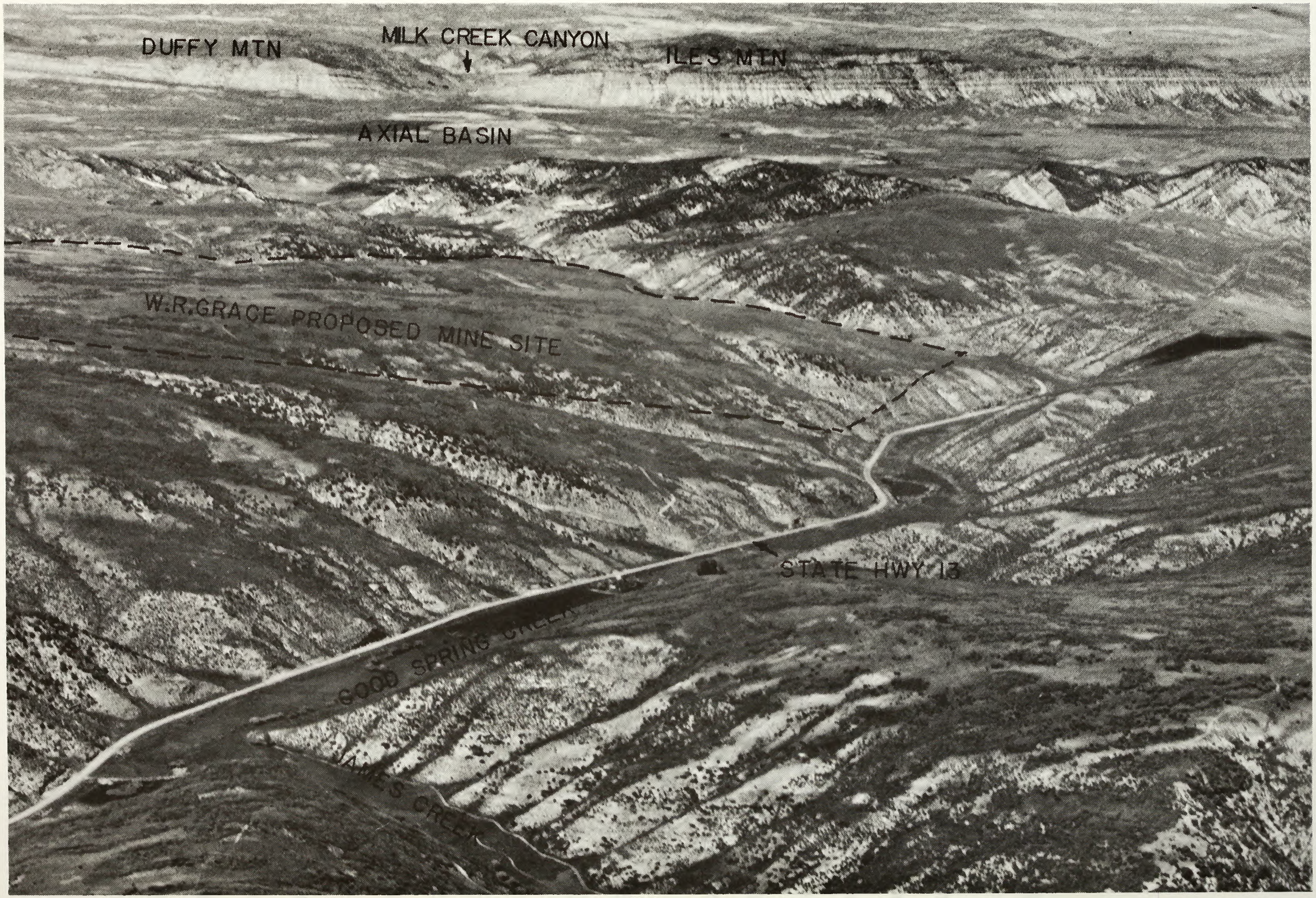


FIGURE GRII-1

Aerial oblique view east, showing Route A along Yampa River's steep south bank in NW ¼ Section 12, T.5N., R.92W.

6,130 feet elevation, the route would climb to 6,210 feet in the 3-mile stretch along this canyon. It would cross Axial Basin along Wilson Creek rising to 6,340 feet at the southern terminus.

Stratigraphy

Stratigraphic formations involved in the proposed railroad route include from oldest to youngest: The Mancos Shale, Iles Formation, Williams Fork Formation, and the Lewis Shale, all of Late Cretaceous age. Unnamed geologic materials include alluvial silts, sands, and gravels along the streams, gravels on terraces and upland surfaces, rock fall sandstone blocks, talus, and landslide, slump, and earthflow materials.

Geology of the area has been described by Hancock (1925) and by Lauman (1965); most of the information here is taken from these reports.

The Mancos Shale is about 5,000 feet thick and consists mainly of black, dark-gray to light-gray, and tan shale. The upper 800 feet is characterized by three or four thin-bedded, flat-bedded, tan sandstone units that are more resistant to erosion than the shale, but much softer than sandstone units in the overlying Iles Formation. Some beds of the Mancos are calcareous. The formation is well exposed along the south side of Iles Mountain.

The Iles Formation, about 1,400 feet thick, consists of alternating beds of sandstone, shale, and some coal. The beds are mostly a few feet to a few tens of feet thick. Most sandstones and some shales are calcareous. Some sandstone beds are also partly cemented by iron oxides and contain concretions. The sandstones are fine to medium grained, thin to medium-bedded with a few massive beds, and most are quite resistant to erosion.

The Trout Creek Sandstone Member, 62 feet thick here (Lauman 1965), is the top unit of the Iles Formation; it is massive-fine to medium-grained sandstone that forms a conspicuous cliff in most places. The Iles is well exposed along the canyons of Williams Fork River and Milk Creek, and on the high south-facing escarpments of Iles and Duffy Mountains.

The Williams Fork Formation, about 1,700 feet thick, consists of alternating beds of sandstone, sandy shale, and coal. The sandstone beds are mostly lenticular, brown to white, very fine to medium grained, calcareous, with some iron oxide stain and cement. In some places the rock is reddened and hardened as a result of coal having burned at the outcrop. Some shale beds are black, carbonaceous, and partly calcareous. The most important coal beds are in the lower part of the formation. The Twentymile Sandstone Member, about 106 feet thick here, is a distinctive white, medium-grained, calcareous, porous, masssive ledge-forming sandstone unit about 870 feet below the top of the formation. The lower part of the overlying 870 feet of rocks is a non-marine sequence of sandstone, siltstone, shale, and coal beds. The sandstones are fine-to medium-grained, thin-to massive-bedded, carbonaceous, friable, and discontinuous. They are interbedded with gray to black, carbonaceous, locally calcareous shales, light brown to buff carbonaceous siltstones, and coal beds (Lauman 1965). Limonitic calcareous concretions, about .25 to 2.0 inches in diameter, are present throughout these beds. The uppermost part of Williams Fork Formation is of interbedded nonmarine and marine shore-line deposits about 400 feet thick, and is transitional into the overlying Lewis Shale. This transitional unit consists of white to buff, fine to coarse-grained, friable, permeable, porous, calcareous, limonite-stained, thin-to massive-bedded sandstone and interbedded siltstone, coal, and gray to dark brown carbonaceous shale. These upper sandstone beds contain isolated limonitic calcareous concretions that range from one inch to five feet in diameter. These large concretions form a convenient marker of the contact with the overlying Lewis Shale. Best exposures of Williams Fork Formation are along the Yampa River north of its junction with the Williams Fork.

The Lewis Shale has a total thickness of about 1,600 feet, but only about the lower 500 feet remains in the area of the proposed railroad (Lauman 1965). There are good exposures along the Yampa River in the Big Bottom area, but the Lewis mostly underlies broad rolling areas with few exposures. It consists of gray to dark-gray marine shale, but weathers to lighter gray and tan colors.

The Browns Park Formation of Miocene age occurs as scattered remnants in the Axial Basin, but none is believed to underlie the railroad route. The closest occurrence known is on the hill trending northeasterly in Section 15, T.4N., R.93W. Here, the base of the Browns Park is at an altitude of about 6,430 feet and the remnant is about 100 feet thick. It consists of partly limonitic and conglomeratic, cross-bedded, friable white to tan sandstone.

Alluvium along the streams is of unknown thickness, but the feasibility study by Morrison-Knudsen Company, Inc., suggests thicknesses on the order of 20-30 feet along the Yampa and Williams Fork Rivers and Milk Creek. The alluvium consists mainly of silt and sand, with lesser amounts of clay and fine gravel.

Terrace gravels are mostly thin, probably less than 10-15 feet. They include pebbles and small cobbles of hard rock types such as granite and quartzite. The feasibility study mentions gravel pits worked by the State Highway Department in E 1/2 Section 21, T.6N., R.91W., and describes them as "thin and mixed with considerable silt".

Structure

The proposed railroad route would begin on the south flank of the Craig Anticline, where beds of the Williams Fork Formation dip about 5-10° southward. Route A would turn south across the axis of the wide and gently folded Big Bottom Syncline where the bedrock is Lewis Shale. The contact of Lewis Shale and underlying Williams Fork Formation is reached about 1 1/4 miles north of the Yampa-Williams Fork River confluence, and these beds dip 8-10° northward into the syncline.

The route would turn west from the Yampa-Williams Fork confluence and cross the northward-plunging axis of Williams Fork Anticline in SE 1/4 Section 36, T.6N., R.92W. Bedrock westward to Milk Creek, except for about one mile in the Iles Formation, in Sections 1 and 12, T.5N., R.92W., is the Williams Fork Formation. The route would follow the northwest-trending axis of the Round Bottom Syncline in Sections 11 and 2, T.5N., R.91W. On the very steep slope at the sharp bend of the Yampa River in NW 1/4 Section 12, the beds dip about 3° west-southwest (Gale 1910) and almost parallel the hill slope. West to the mouth of Milk Creek canyon, the route would go along the gentle west limb of the Round Bottom Syncline, and after it turns south into Milk Creek canyon it would follow this limb, which coincides with the north flank of Axial Basin Anticline.

The contact between the Williams Fork and Iles Formations is near the mouth of this canyon; thus bedrock along the canyon is the Iles Formation. The contact between the Iles and Mancos Shale is at the upper end of this canyon. The route up Wilson Creek would be on alluvium or Mancos Shale on the north flank of the Axial Basin Anticline, and the axis of this fold is crossed in Section 14, T.4N., R.93W.

Geomorphology

Landforms along the proposed railroad route are mostly the result of differential erosion of hard and soft rocks which had been moderately folded.

The dominating topographic features, Williams Fork Mountains and Iles Mountain, are composed of resistant beds of the Iles and Williams Fork Formations which have been tilted slightly north. Deep erosion has breached the Axial Basin Anticline and exposed the softer Mancos Shale below the Iles Formation. The Mancos forms widely rolling plains with only small rounded hills and ridges. Hard sandstone beds of the lower part of the Iles cap the steep, straight, south-facing escarpment of Iles Mountain. The Lewis Shale forms broad rolling plains north of the Williams Fork and Iles Mountains, stretching east and west from the Craig area.

The Browns Park Formation of Miocene age originally covered virtually the entire region. The Yampa River established its present widely meandering course on the Browns Park, and Williams Fork River and Milk Creek became tributaries to it then. Over a long period of time regional erosion lowered the general land surface. As the soft Browns Park Formation was removed, the streams finally cut down into the hard underlying formations.

As their courses had become firmly established in deep valleys, they were forced to erode these harder beds of the Iles and Williams Fork Formations rather than seek their courses in softer beds, and consequently have become deeply incised in these harder beds; thus they are termed superposed (or superimposed) streams. Resistance to erosion of these beds prevents easy widening of the valleys. Where the streams encounter softer strata, as in Big Bottom and Round Bottom (Lewis Shale) and Axial Basin (Mancos Shale), they erode wider valleys and deposit thicker accumulations of alluvium. The narrow valleys with steep sides are ideal settings for rock fall, talus, earth flow, creep, and landslide deposits; some of these may be observed there.

Paleontology

Exposed areas of Late Cretaceous age are within the area of the proposed railroad. They include from oldest to youngest: Mancos shale, Iles Formation, Williams Fork Formation, and the Lewis shale.

The Mancos shale contains predominately marine shales with littoral (of the shore) sands in the upper part of the formation; ammonites, baculites, scaphites, and inoseramus clams are found in the very fossiliferous formation. Both the Williams Fork and Iles Formation contain fossil leaves, ammonites, and inoseramus clams (within interbedded shales). Ammonites and other marine fossils occur in the Lewis shale.

A considerable amount of recent alluvial material also lies in the area of the proposed route. No specific information on its potential for fossils is available.

Water Resources

Ground water

Ground water underlies the proposed railroad routes at a depth that rarely exceeds a few tens of feet. The water is for the most part contained in relatively impermeable shales and sandstones. Only the alluvium of the Yampa and Williams Fork Rivers has moderately high permeability. The water table is recharged by precipitation throughout the area and generally discharge is to nearby streams and/or water-loving vegetation in the valleys. Water in the shales is marginally suitable for livestock and generally unsuitable for domestic or irrigation use; water in the sandstone and alluvium is suitable for livestock and marginally suitable for domestic use or irrigation.

Surface water

Streams which might be impacted by the proposed W. R. Grace Railroad are listed below in downstream order and tributary rank.

- Yampa River
  - Johnson Gulch
  - Williams Fork
  - Milk Creek
    - Wilson Creek
      - Taylor Creek
      - Jubb Creek

The railroad would begin from a point on the proposed Colorado-Ute Railroad spur about three miles southwest of Craig and run generally southwest, crossing Johnson Gulch, Williams Fork, thence down the Yampa River to the mouth of Milk Creek, thence up Milk Creek to the mouth of Wilson Creek. At the mouth of Wilson Creek the route would follow Wilson

Creek about one half mile to Jubb Creek, thence across and up the east side of Jubb Creek about three miles where the route would traverse the Jubb Creek - Wilson Creek divide, cross Wilson Creek, and then continue to Taylor Creek. At Taylor Creek the route would continue about two miles upstream to the end-of-track and a loading facility.

All the major streams which might be impacted by railroad construction head at high altitudes and exhibit the same characteristics of other streams in the Yampa River system, as discussed in Chapter IV of the Regional Analysis. That is, the bulk of their runoff occurs in May and June and their low base flow is sustained mainly by ground water. In summer months the flow of these streams is diminished by irrigation withdrawals.

Streamflow data for station 09249500 Williams Fork at Hamilton, 09250000 Milk Creek near Thornburgh, and 09251000 Yampa River near Maybell are given in Chapter IV of the Regional Analysis. The estimated peak discharge for the flood with a recurrence interval of 50 years is 300 cfs for Wilson Creek and the estimated average annual runoff for Taylor Creek is 125 acre-feet. Good Spring Creek would not be impacted by the railroad, but contributes to Milk Creek above Milk Creek Canyon. The estimated peak discharge for Good Spring Creek for the 50-year flood is 400 cfs.

No data are available for Johnson Gulch or Jubb Creek. Both are intermittent streams and probably contribute small flows as a result of snowmelt or intense rainfall.

Peak discharges of the gaged streams, as is generally true of the Yampa River system, either do not equal the flood with a 50-year recurrence interval or, as with the Yampa River near Maybell, exceed the 50-year flood by only a small amount. Therefore, major floods probably would not occur along the railroad right-of-way.

Tables GRII-1 to GRII-2 summarize some of the general quality parameters that have been analyzed in the study area. It is usually true that dissolved solids increase and turbidity decreases as flow decreases. Dissolved oxygen concentrations usually will decrease as temperature increases during summer; however production of oxygen by algae during warm periods can increase dissolved oxygen in the water. Nutrients such as nitrates and phosphates enter surface waters from ground water and surface runoff; they do not follow a definite seasonal pattern. Sulfate and bicarbonate show a direct relation to dissolved solids. One measure of the tolerance of a water quality system to external changes is pH stability. The Yampa River has little seasonal pH variation and is slightly alkaline, as are most western streams. Toxic elements such as arsenic, cadmium, copper, lead, silver, zinc, and selenium have been constantly below the toxic effect threshold in the Yampa River near Maybell. Arsenic, cadmium, lead,and silver have not been above detection limits in any of the more than 15 samples collected at this station since 1968. Only one of 23 tests for copper, four of 34 tests for zinc, and four of 28 tests for selenium found measurable quantities. The one copper sample indicated a very high concentration and probably is an anomalous value. Other element concentrations were below the maximum criteria (EPA 1972).

TABLE GRII-1

Water Quality of the Yampa River Near Maybell

Period of Record 1968-Present

Parameter and Unit of Measure[1/]	Time Period Warm Baseflow Aug-Oct	 Cold Baseflow Nov-Mar	 High Flow Apr-Jul
Turbidity JTU[2/]	16±18	45±81	332±401
Dissolved Solids mg/l	300±56	374±47	221±147
Temperature °F	58±9	33±2	54±10
Flow CFS	345±133	368±73	4323±3497
Nitrate mg/l	0.25±0.39	0.28±0.30	0.47±0.44
Phosphate mg/l	0.22±0.33	0.09±0.15	0.20±0.15
Bicarbonate mg/l	173±18	193±25	118±37
Sulfate mg/l	87±48	110±27	50±45
pH	8.0±0.5	7.9±0.3	7.7±0.3

[1/] Values for parameters presented in this table are expressed as a mean (the first number given) and one standard deviation (the second number given).

[2/] JTU = Jackson Turbidity Unit; Mg/l = milligrams per liter

SOURCE: Colorado Department of Health 1975

TABLE GRII-2

Water Quality of Wilson Creek and Good Spring Creek

(Period of Record 1974 - Present)

Parameter and Unit of Measure[3/]	Sample Location	Warm Baseflow Aug-Oct	Cold Baseflow Nov-Mar	High Flow Apr-Jul
Turbidity	Good Spring Cr.	9±10	101±132	1/
JTU[2/]	Wilson Cr.	3.5±0.7	64±74	1/
Dissolved Solids	Good Spring Cr.	998±156	984±204	1/
mg/l[2/]	Wilson Cr.	1448±172	1166±104	1/
Nitrate	Good Spring Cr.	1/	1/	1/
mg/l	Wilson Cr.	1/	1/	1/
Phosphate	Good Spring Cr.	0.01	0.02±	1/
mg/l	Wilson Cr.	0.01	0.02±	1/
Bicarbonate	Good Spring Cr.	435±100	545±36	1/
mg/l	Wilson Cr.	407±24	527±20	1/
Sulfate	Good Spring Cr.	234±291	425±190	1/
mg/l	Wilson Cr.	146±147	396±41	1/

Composite of data available from VTN samples stated as mean standard deviation

[1/] Insufficient data at this time

[2/] JTU = Jackson Turbidity Unit; Mg/l = milligrams per liter

[3/] Values for parameters presented in this table are expressed as a mean (the first number given) and one standard deviation (the second number given).

SOURCE: Colorado Department of Health 1975

Living Components

Soils

The proposed railroad right-of-way would cross several different landforms and three soil associations (21, 35, and 41), which are shown on the general soil map in Appendix D Estimated Soil Properties Significant to Engineering and their Interpretation. This description map is referred to in the Regional Analysis, Chapter IV. It lists soil properties, limitations, and suitabilities.

A soil association consists of two or three distinctly different soil taxonomic units (soil series) occurring in a regular repeating pattern on the landscape. Soil associations were developed because basic soil data are not adequate to locate or identify individual soil series occurring with the right-of-way.

The productivity, potentials, and suitabilities of the different kinds of soil may vary widely on a small scale, but on a larger scale the pattern of occurrence of the soils enables the land user to identify suitabilities, limitations, and potentials of the soil for construction, rehabilitation, reclamation, and land treatment practices.

Narrative discussion of soil associations that would be crossed by the proposed railroad is designed to give a reasonably clear picture of the landscape and its soils, geology, climate, vegetation, and current use, and general productivity, potentials, and limitations. Emphasis is given to a discussion of landform to provide a general impression of the area. The proposed railroad right-of-way would cross soil associations 21, 35, and 41 as described in the Regional Analysis. Acreages and boundaries for each soil association are subject to change as detailed soil data become available.

Soil association 21 occurs on uplands and in valleys and associated stream floodplains. Shrink-swell potential is high; valley soils are susceptible to flooding during spring and early summer. They are highly productive for pasture and irrigated cropland. If vegetative cover is removed water erosion hazard is high. Soils of the uplands are less productive than of the bottom lands and are used for grazing and limited dry cropland.

Soil association 41 occurs on sloping to steep uplands, mesas, and breaks. Suitability for fill material is poor because of shallow depths to bedrock. Productivity is low to medium and is used primarily for range, recreation, and wildlife. Erosion hazard is high when the vegetative cover is removed.

Soil association 35 occurs on the nearly level to gently sloping uplands (plains). These soils have a fair suitability for fill material and are used primarily for range, urban development, recreation, and wildlife. Erosion is moderate when vegetative cover is removed.

Appendix D provides additional physical and chemical data, suitabilities and limitations for construction, reclamation potential, etc., for each soil association.

Terrestrial Flora

Vegetation along the proposed railroad route is typical of vast areas of intermountain and plateau country of Colorado's western slope. Except for cultivated land, the landscape is dominated primarily by sagebrush communities. Figure GRII-05 illustrates vegetation and therefore land use along the proposed route as well as along alternate routes; vegetative types present are: sagebrush, mountain shrub, pinyon-juniper, cropland, and river bottom (riparian).

Numerous factors are responsible for the present condition and extent of plant communities; no areas exhibit pre-Caucasian conditions. Livestock grazing has had the most significant effect on composition and distribution of existing plant communities. Soils, topography, and fire also are significant in overall distribution of community types. Vegetation occurs as a mosaic rather than as a broad expanse because of these various factors. No rare or endangered plant species have been identified along the proposed corridor route; however the vegetation has not been analyzed in detail.

For discussion, plant communities will be analyzed in segments; more detailed analysis of each type is presented in Chapter IV of the Regional Analysis section of this statement.

Segment 1: Colorado Ute spur to Yampa/Williams Fork junction

South of Craig the Yampa River contains substantial floodplains up to 1/4 mile wide. This zone contains riparian vegetation dominated by narrow leaf cottonwood (*Populus deltoides*) and willows (*Salix* spp.). Species within this vegetation type require readily available water throughout their growing season and are limited in distribution to the river courses. During summer livestock are maintained in many of the floodplain pastures of this type. Depending on the width of the floodplain, riparian vegetation

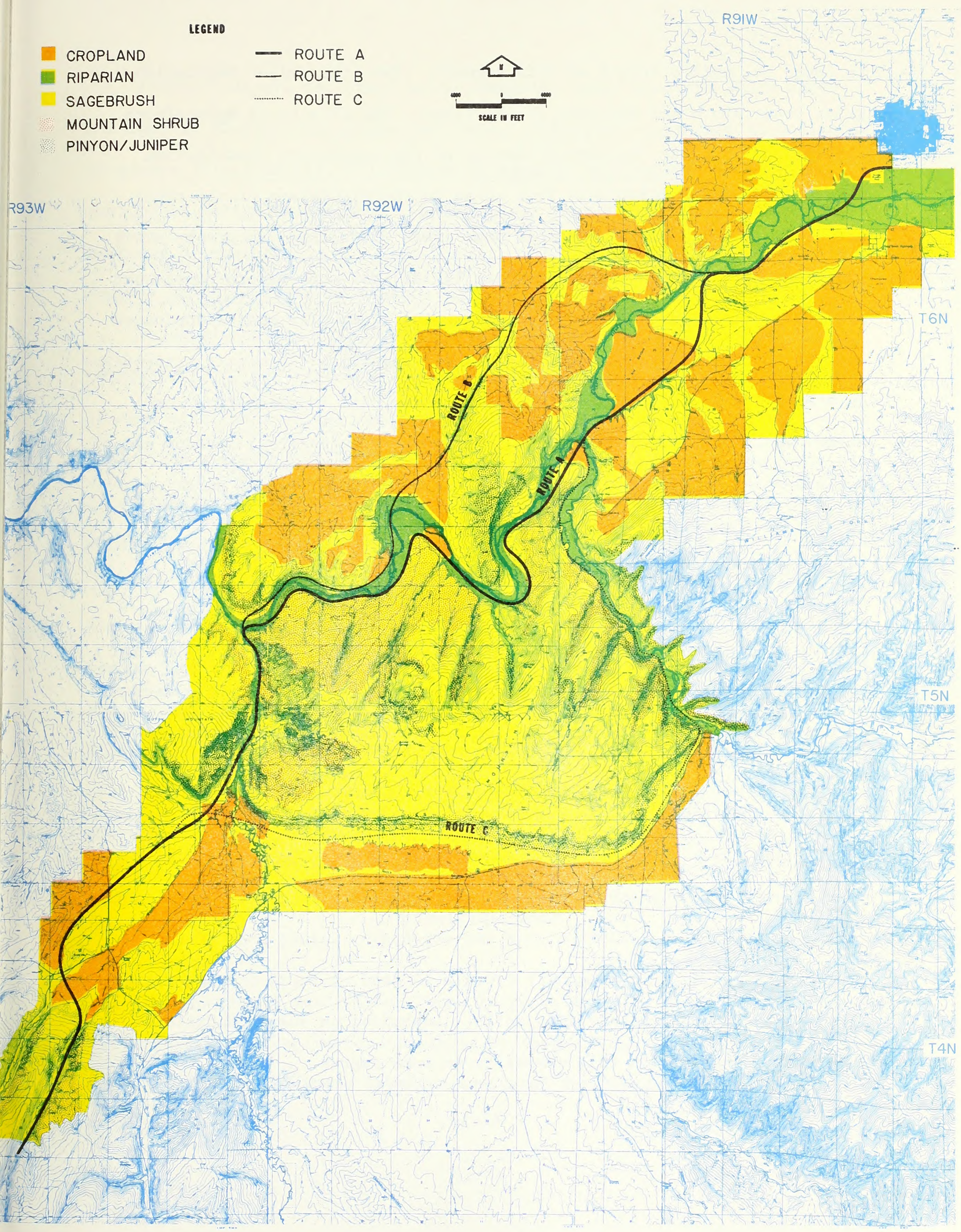


Figure GRII-05 Vegetative types crossed by route A and alternate routes of the proposed W.R.Grace railroad.

is found the entire length of this segment. Two other major vegetation units occur above and adjacent to the river. The effects of agriculture are evident from the "patchwork" nature of the vegetation distribution (Figure GRII-05). Relatively flat areas in the floodplain of the river are utilized for haylands, whereas some areas of rolling topography above the river have been converted to wheat fields; the more severe topography and gullies are dominated by sagebrush communities. The most conspicuous species in the sagebrush communities is big sagebrush (*Artemesia tridentata*). In areas with a shallow water table, excessive salt concentration, or abandoned fields, black greasewood (*Sarcobatus vermiculatus*) invades and dominates the site. Examples of this vegetation occur in the north end of the Big Bottom Section of this route segment.

Segment 2: Yampa/Williams Fork to Milk Creek

Segment 2 follows the flood plain of the Yampa River from its confluence with the Williams Fork to the confluence of Milk Creek. Riparian vegetation occupies the river bank along the entire course of this segment. At Round Bottom, the floodplain has been extensively cultivated for hay production.

Where the topography is more severe, sagebrush rangelands are replaced by mountain shrub. Dominated by Gambel's oak (*Quercus gambelii*), and serviceberry (*Amelanchier alnifolia*), this community is typical of slightly higher or more mesic condition than the sagebrush. Along most of the proposed segments, this community type is located on north or east-facing slopes with deep-moderately deep soils. Depending on stand condition, sagebrush is present in this community to some degree.

Pinyon-juniper, the other major community type, develops where rocky outcrops or bluffs exist above the river. This plant community is dominated by pinyon (*Pinus edulis*) and juniper (*Juniperus utahensis*). In this portion of Moffat County, the pinyon-juniper community is almost totally composed of juniper.

Segment 3: Milk Creek to loadout site

Vegetation along Milk Creek is primarily riparian with some cropland, mountain shrub, and sagebrush. From the mouth of Wilson Creek to the loadout site, much of the vegetation of Axial Basin has been modified by agriculture; remaining lands are mostly sagebrush with some pinyon-juniper. All three terminals under consideration would be located in these same vegetative types.

The croplands produce hay and grains, principally winter wheat. Although crop yields vary due to weather conditions, common annual yields for hay are 2 tons/acre, and 25 to 35 bushels/acre for grain. Grain crops are dryland farmed on rolling hills above Round Bottom, near Thompson Hill, and in Axial Basin. Because of marginal rainfall, the common farming practice is to leave fields fallow every other summer. Many grain fields are unfenced and mixed in with adjacent sagebrush grazing land.

Terrestrial Fauna

Wild fauna

All species of terrestrial fauna known or expected to be found along the proposed railroad route are listed in Appendix D. Faunal distributions will be keyed to the route segments indicated in Figure GRII-2 where applicable.

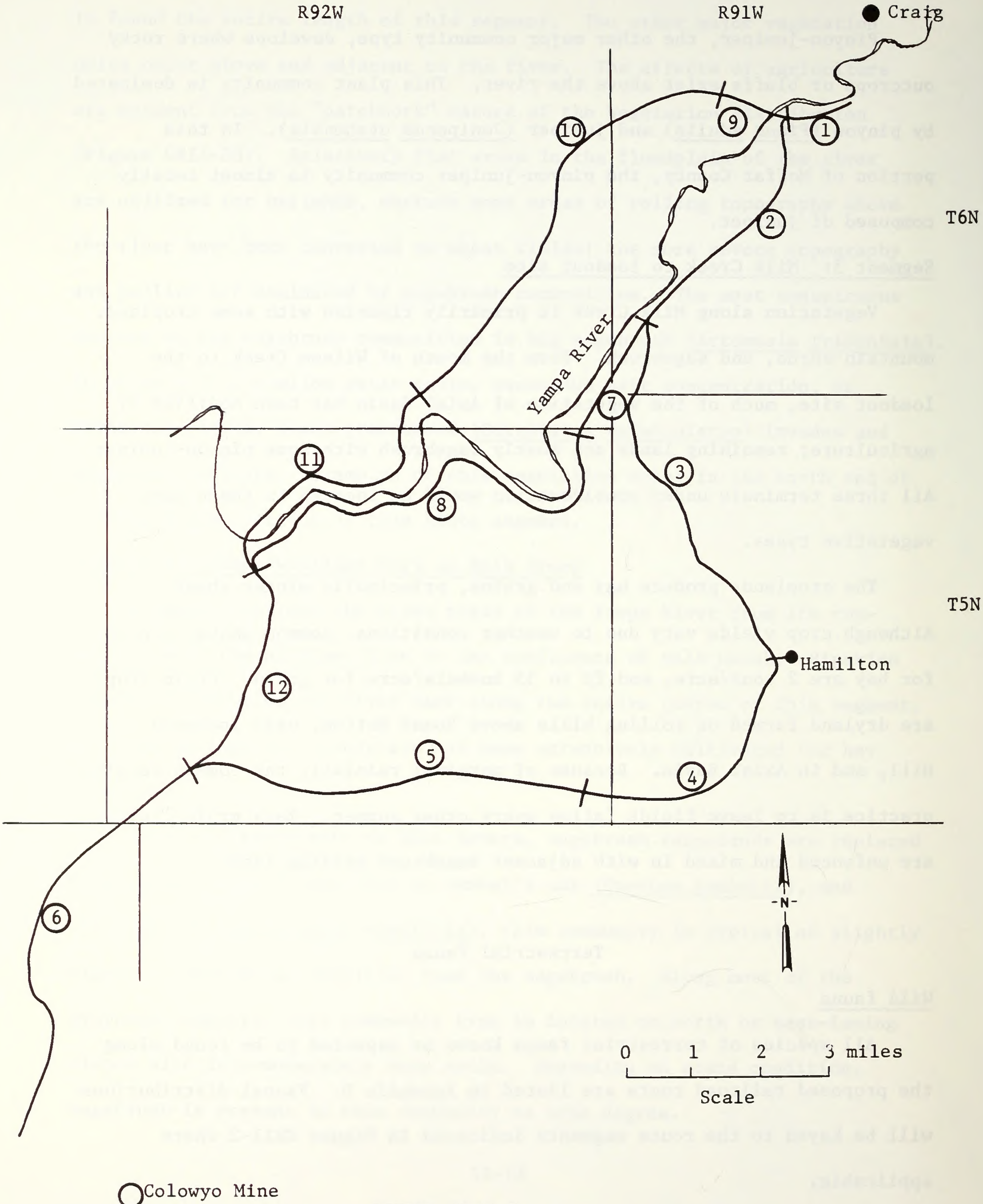


FIGURE GRII-2

Segments for description of faunal distribution.

Big game

Mule deer (Odocoileus hemionus) and elk (Cervus canadensis) are the most common big game species known to inhabit the subject area. Cougar (Felis concolor), black bear (Ursus americanus), and pronghorn (Antilocapra americana) also occur in this area but are less numerous.

Mule deer. Ground and aerial observations during the winter 1974-1975 and data from the Colorado DOW indicate large deer winter concentrations in the following areas:

1) From the confluence of Williams Fork and Yampa Rivers downstream to the confluence of Milk Creek and Yampa River, primarily along the south side of the river (Segments 7 and 8). Deer numbers have been estimated at approximately 1,000 animals;
2) In both Iles and Duffy Mountains to either side of Milk Creek, along segment 12. Approximately 200 deer have been estimated for Iles Mountain and about 150 animals are believed to winter in Duffy Mountain.

Mule deer migrate into the area in the fall. Many animals come from as far as 40 miles away and concentrate along the Williams Fork and Yampa Rivers, segments 3, 7, and 8. (Mule deer key use areas and migration routes are shown in Figure GRII-3.)

Substantial numbers of mule deer have been observed to remain in this general area yearlong. In early June 1975 numerous deer were observed on Iles Mountain, along segment 8. Many of these animals had fawns with them, indicating they had fawned in the immediate area. The Colorado DOW

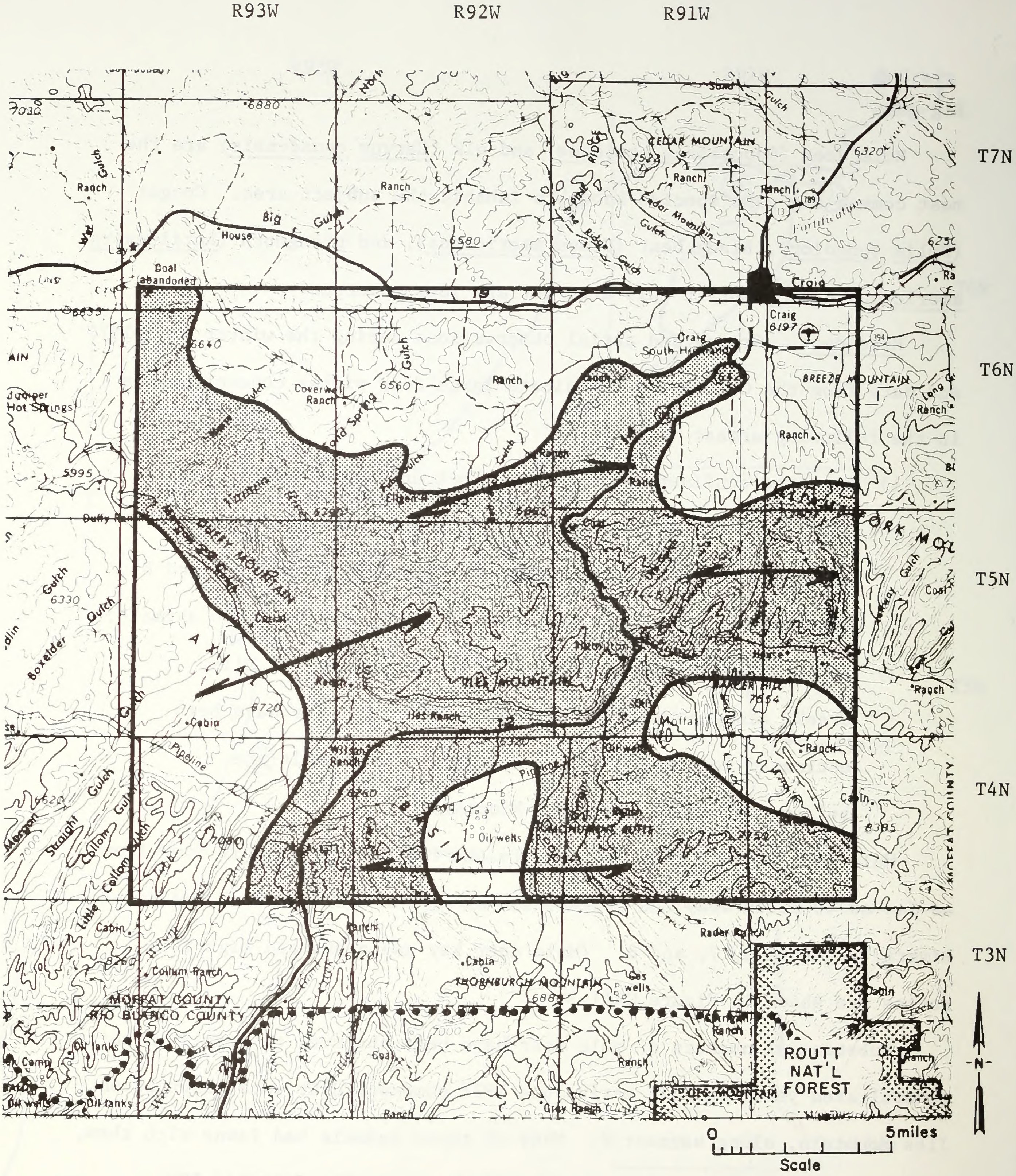


FIGURE GRII-3

Mule deer key use areas (shaded) and migration routes (⟶).

believes that as many as 200-300 mule deer are yearlong residents of Iles and Duffy Mountain areas.

Cover is provided by a variety of brush, trees, and topographic features; major cover species include juniper, oak, and serviceberry (see the vegetation section for a more complete floral species list).

Water requirements of mule deer are met by several ponds and stock tanks, snow, Milk Creek, and Yampa and Williams Fork Rivers.

Because of the bulk of private land surface ownership in portions of this area, quality and quantity of deer winter browse is not known. However, the majority of the deer seen in the area during winter months appear to be well-fed and well-nourished.

Elk. Elk occur in most of the same areas as mule deer. Important elk winter concentration areas appear to be in Duffy and Iles Mountains on either side of Milk Creek, segment 12.

Elk numbers on Iles Mountain appear to decrease progressively as spring turns to summer. The Colorado DOW estimates that as many as 50 elk remain in these mountains yearlong. During the winter months many elk move into this area from the Williams Fork Mountains to the east and elk numbers increase to about 500 animals. Key use areas and migration routes are shown in Figure GRII-4.

The elk that winter along Williams Fork River move into Williams Fork Mountains during the summer months; very few animals live in the immediate vicinity of the river during this period. However, elk are killed on the highway in the Hamilton area yearlong, indicating that some elk move

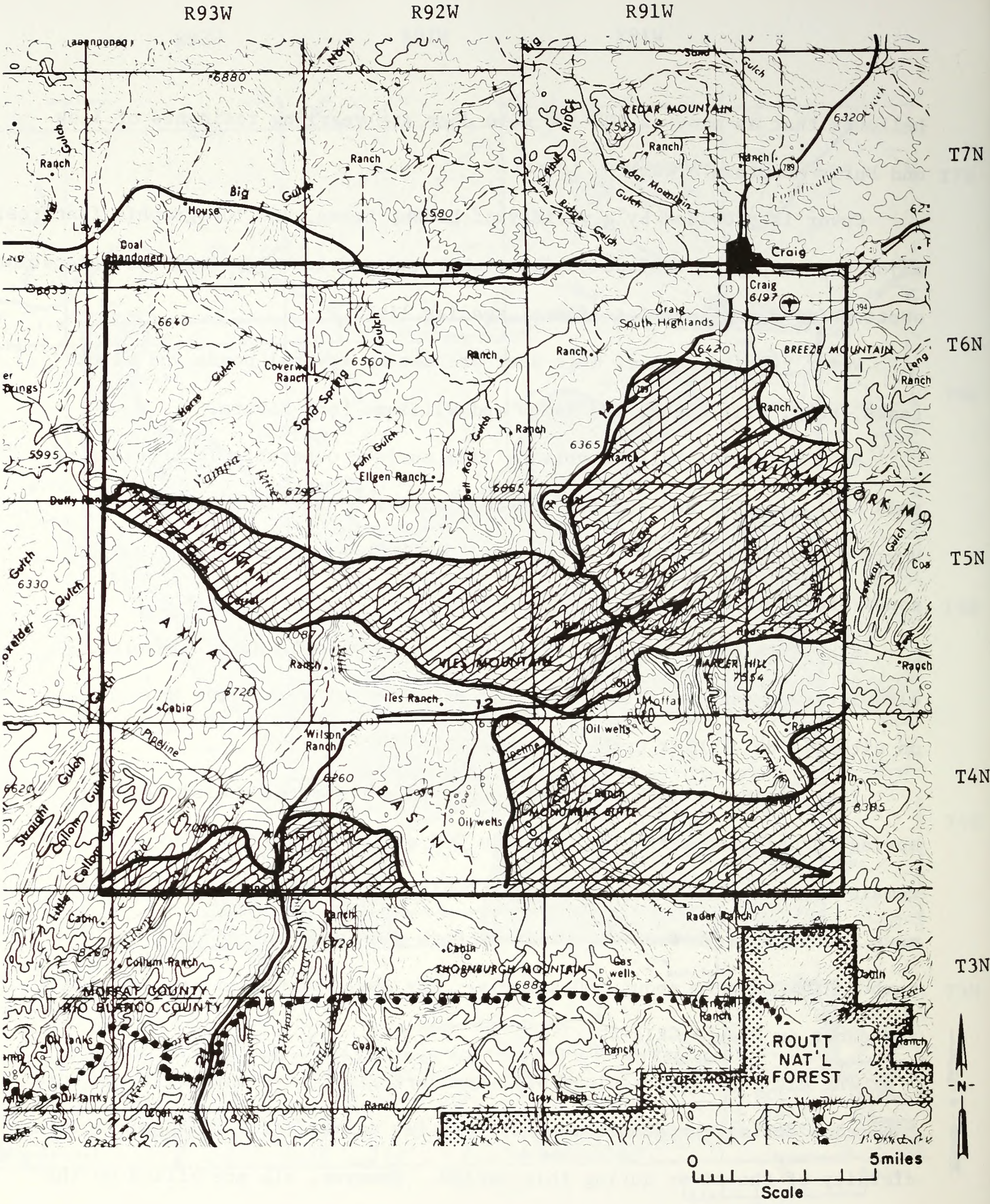


FIGURE GRII-4

Elk key use areas (shaded) and migration routes.

freely between Iles and Williams Fork Mountains during summer months. Food, water, and cover information is basically the same as for mule deer (listed in the previous section).

Pronghorn antelope. Few pronghorns are found within this region; however the trend appears to indicate an upward swing in pronghorn antelope use.

A small herd of about 25 animals is established in Axial Basin in the vicinity of segments 5 and 6 at the head of Milk Creek Canyon (Figure GRII-5). Additional use has been recorded along segment 10 in the Bell Rock Gulch area. Scattered reports also indicate an increase in the use of segment 8 area by pronghorns.

Black bear. Black bears are not considered common along the proposed railroad route. These animals have been observed on Iles and Duffy Mountains, but only on rare occasions and generally in areas away from the proposed route; exact numbers and extent of their activities within this area are not known.

Cougar. Only one confirmed sighting of a cougar has been reported in the area in recent years. However, the existence of suitable habitat values, such as adequate food, cover, and rugged terrain, indicate that there is a good possibility that cougars could inhabit the more inaccessible regions of Iles and Duffy Mountains.

Small mammals

Cottontail rabbits are the only species of small game mammal that is known to occur along the proposed railroad route; they might be found

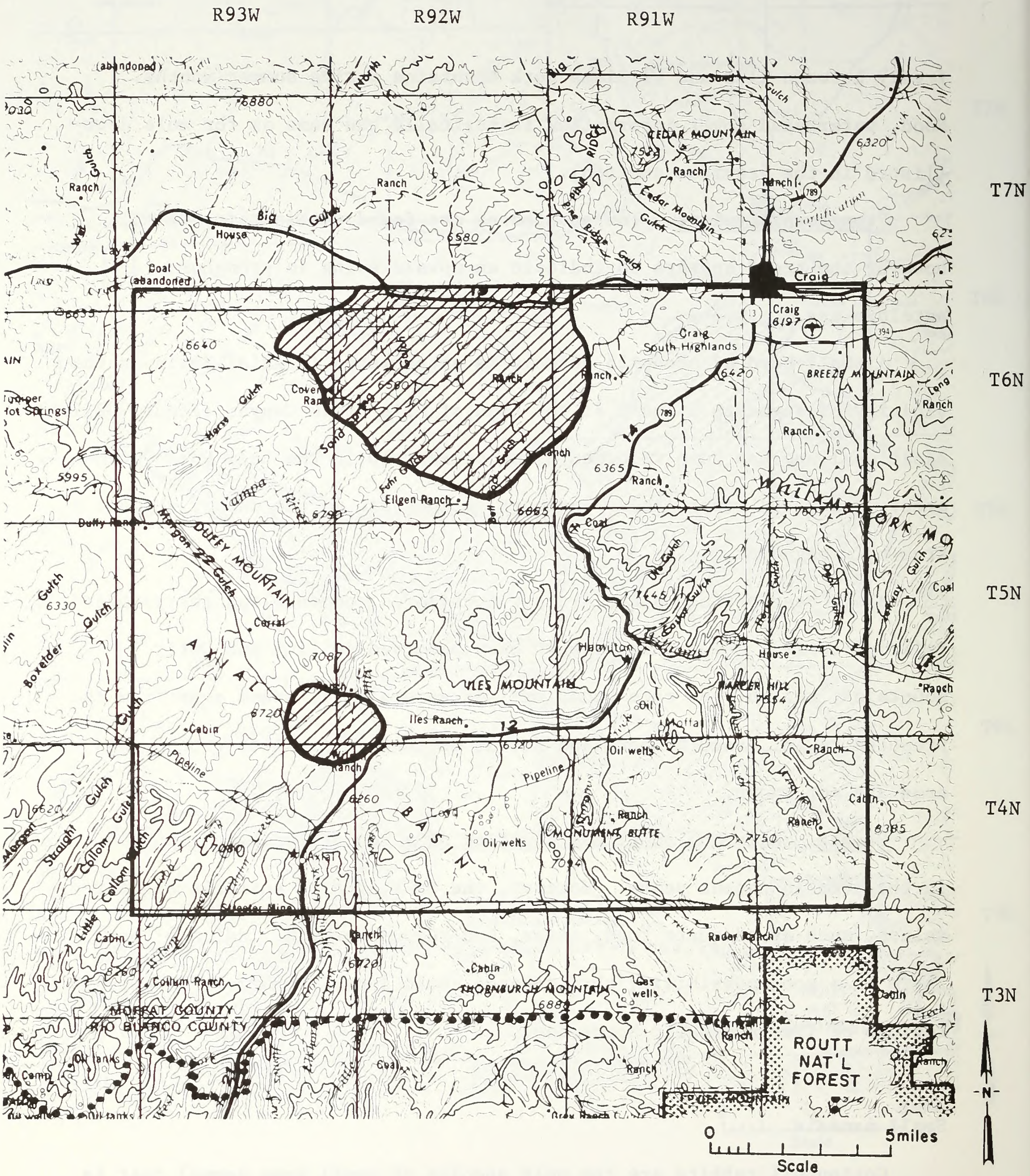


FIGURE GRII-5

Pronghorn antelope use areas (shaded).

along any segment. In the past five years lagomorph numbers have declined severely in northwestern Colorado. Both cottontail and jackrabbit numbers have been very low for the past three years and have not shown significant signs of recovery.

Beaver and muskrat are found along the Yampa River; numbers, exact distribution, and harvest data are not available for these species or other furbearers within the area.

Coyote, fox, and bobcats are found within this area. Coyotes are the most common; they are found throughout the area along any route segment. Fox and bobcats are less numerous and generally are found along the rivers. The trend in fox numbers appears to be upward whereas bobcat numbers are reportedly stable in this part of Colorado. The influence of these predators on local prey species is not known; however, some deer and pronghorn fawns probably are lost to them each year, as well as many rodents, rabbits, and some birds.

A wide diversity of other non-game mammals are also known to occur within the region (see Appendix D). Species' occurrence and distribution depend greatly upon the existence of appropriate habitat values, such as food, water, cover, and living space. For a generalization of these values as they relate to each species see Appendix D.

Game birds

Ducks. Ducks are very common along the Yampa River, especially during spring and fall mitigations. Many breeding pairs are seen by the Colorado DOW and the U.S. Fish and Wildlife Service during annual spring counts in May (Table GRII-3). The actual number of broods along the river is considered low. Because of high water during the peak of the nesting period, few places are available for nesting and some nests are probably inundated (DOW 1975). Primary waterfowl use areas are shown on Figure GRII-6.

Ducks are hunted to a limited degree along the Yampa River during the fall migration period. Harvest figures are not known, but are thought to be low because private land ownership limits accessibility along the river.

Geese. Numbers of geese observed between Craig and Juniper Springs during annual spring counts by the Colorado DOW and the U.S. Fish and Wildlife Service are shown in Table GRII-3. The number of adults generally is high in proportion to the number of nesting pairs because of the limited availability of nesting sites on islands in the Yampa River. Also, breeding pairs observed are based on broods rather than actual nest observations, which does not take into account nests lost during high water. The Colorado DOW considers Yampa River a significant area for sustaining goose populations in the area because of its importance as a nesting area.

Sage grouse. Sage grouse are the most common species of upland game bird found along the proposed railroad route and may occur wherever sagebrush and meadow ecotones are found. Population densities vary and no exact figures are available. Observations indicate the birds occur in greater numbers in Big Bottom, Round Bottom, and Axial Basin areas, where the birds commonly were observed in large flocks during fall and winter.

TABLE GRII-3

Waterfowl Counts - 1969-1975
Between Craig, Colorado and Juniper Springs, Colorado

Ducks	Year	Total Breeding Pairs
	1970	2,350
	1971	2,340
	1972	1,857
	1973	2,571
	1974	2,834
	1975	2,354

Geese	Year	Nesting Pairs	Total Adults
	1969	16	145
	1970	5	174
	1971	14	206
	1972	13	209
	1973	7	271
	1974	No Count	---
	1975	16	121

SOURCE: Szymczak Colorado DOW, 1974 and 1975.

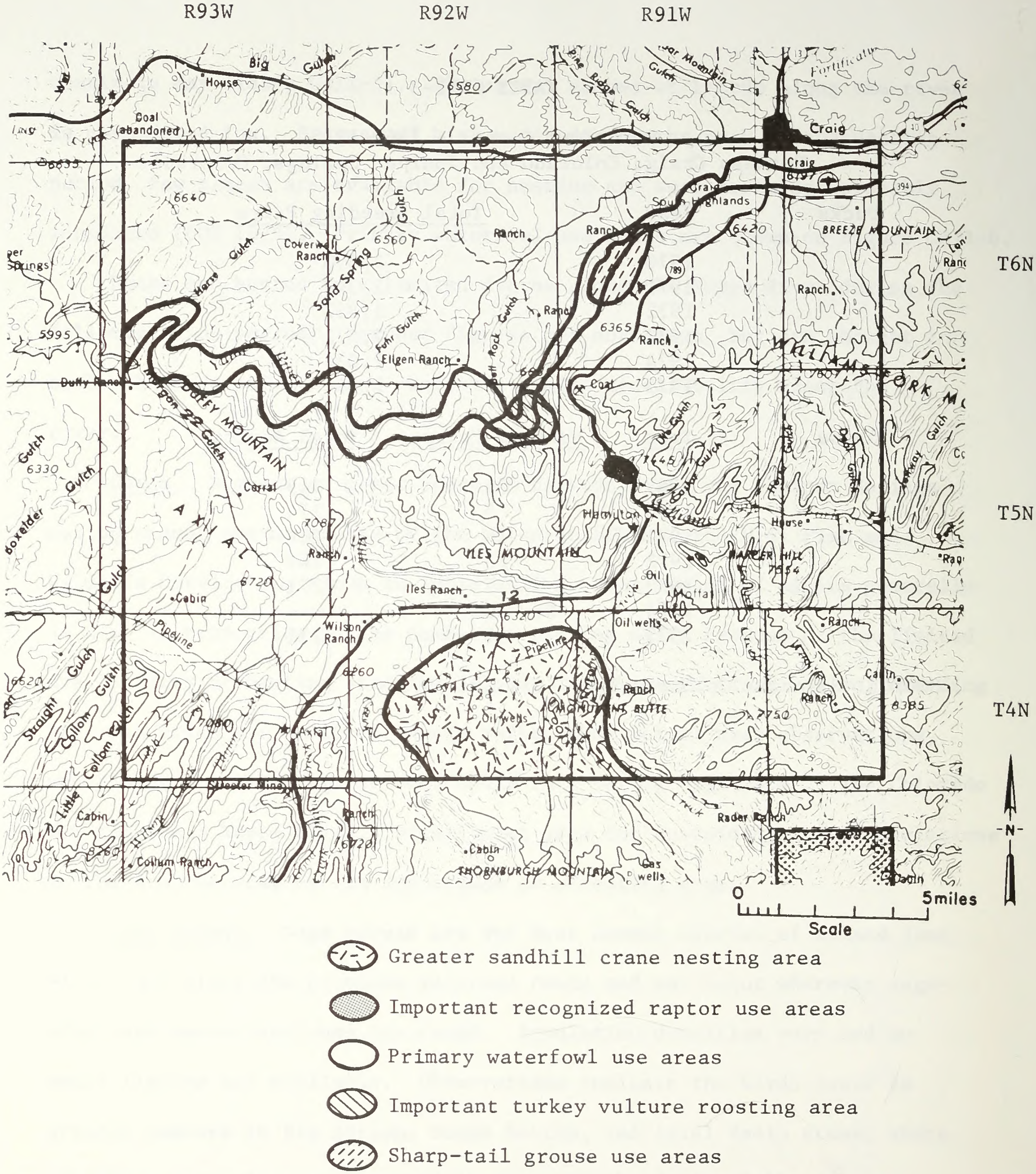


FIGURE GRII-6

Wildlife use areas of particular interest.

In spring the birds concentrate on strutting grounds in open grassy areas and on sagebrush ridges (see Figure GRII-7). Three strutting grounds have been identified in Axial Basin, two of which are located in the vicinity of segment 6. One other strutting ground has been identified; however the large number of sage grouse and the abundance of suitable areas for strutting suggest that more must exist.

Sharp-tailed grouse. This species of upland game bird is found within Axial Basin (see Figure GRII-6); however, data are very limited on their numbers or extent of activity. Sharptails might also use the Bell Rock Gulch area, segments 10 and 11. Numbers and harvests are recorded on a management or county basis; they do not show if there is a significant harvest of sharp-tailed grouse in the area of the proposed route. As with the sage grouse, private land ownership restricts accessibility and thus lowers the harvest of these birds.

Blue grouse. Blue grouse are infrequently observed on Iles Mountain and are not considered numerous.

Chukar. This exotic species was planted by the Colorado DOW in Moffat County in the late 1950s. The Chukar has not been able to establish itself in most of these release sites. The only area that Chukars are known to occur is along Milk Creek, segment 12. No data are available on exact numbers or extent of activities for this species within the area.

Raptors

Birds of prey are common throughout the area of the proposed railroad route. A relatively wide variety of species occur in this area; the

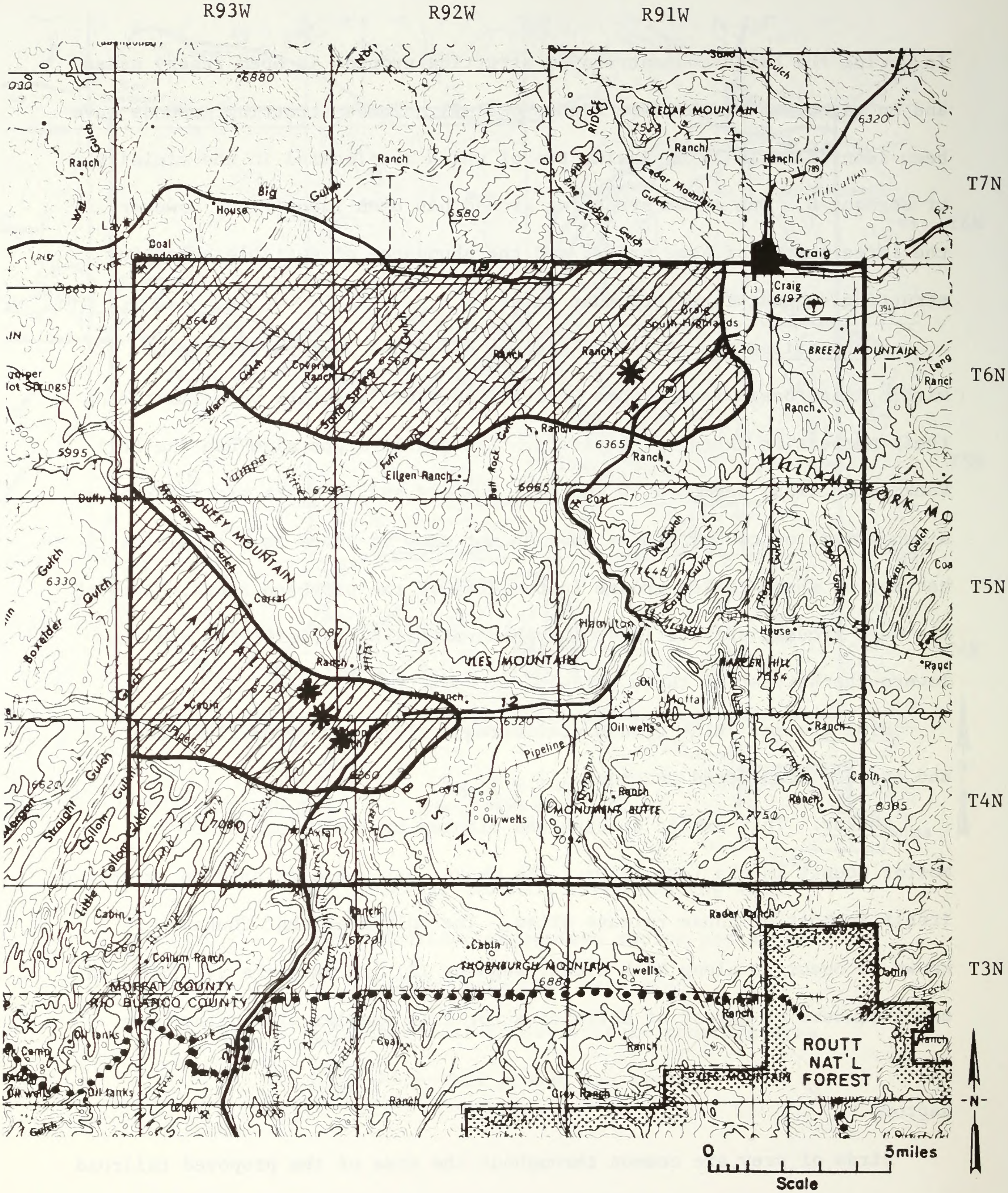


FIGURE GRII-7

Sage grouse distribution, habitat (shaded) and *strutting grounds.

species present depends upon the time of year (see Appendix D).

The Colorado DOW has identified several raptor nests along the Yampa River. Areas of highest raptor use are shown in Figure GRII-6. The number of nesting pairs of large raptors has decreased in the past two years, 1973-1974; the Colorado DOW feels that this decline is directly related to the recent decline in rabbit numbers in this part of the State.

Northern bald eagles also are found in low numbers along the Yampa River during the winter. These birds use large cottonwood trees along the river bottoms for roosting, and require open, ice-free waters for feeding on fish, segments 7 and 8.

A significant turkey vulture roosting area has been identified along Williams Fork River, segment 3 (see Figure GRII-6). This area provides a roost location for juvenile birds during the nesting period; these juveniles are believed to provide a reservoir for the mating population of northwestern Colorado. The turkey vultures are an important segment of the ecosystem of the region because of their scavenging activities.

Amphibians and reptiles

No population or habitat information is available for species of this segment of the terrestrial fauna.

Rare or endangered terrestrial fauna

Species of birds and mammals that have been included under this heading were taken from both the U.S. Department of Interior's threatened species list and the State of Colorado's endangered species list. Species that come under this category are the peregrine falcon (Falco peregrinus), greater sandhill crane (Grus canadensis tabida), and black-footed ferret (Mustela nigripes).

The peregrine falcon has been reported as a rare summer visitor to the area; indications are that a limited number of these birds might return to Moffat County each summer. Although no peregrine falcons are known to nest along the proposed railroad route, it is possible that they would use this area for hunting.

Greater sandhill cranes are known to inhabit the Big Bottom area, segment 2, during spring and summer. This species conducts its courtship in Big Bottom and also nests and rears its broods in this area (see Figure GRII-6). Seven-nine pairs of cranes use this area for nesting. Additional birds might use this same location as a fall staging area prior to their southward migration.

The absence of any known prairie dog colonies along the proposed railroad route creates significant doubts as to the presence of black-footed ferrets in these areas.

Domestic fauna

The proposed route would cross lands owned by 11 people, companies, State or Federal agencies as indicated in Figure GRII-8. Hay and wheat fields would be crossed as well as grazing lands used by both cattle and sheep. Based on records and knowledge of the area, the ability of the vegetation to support domestic animals is broken down as shown in Table GRII-4.

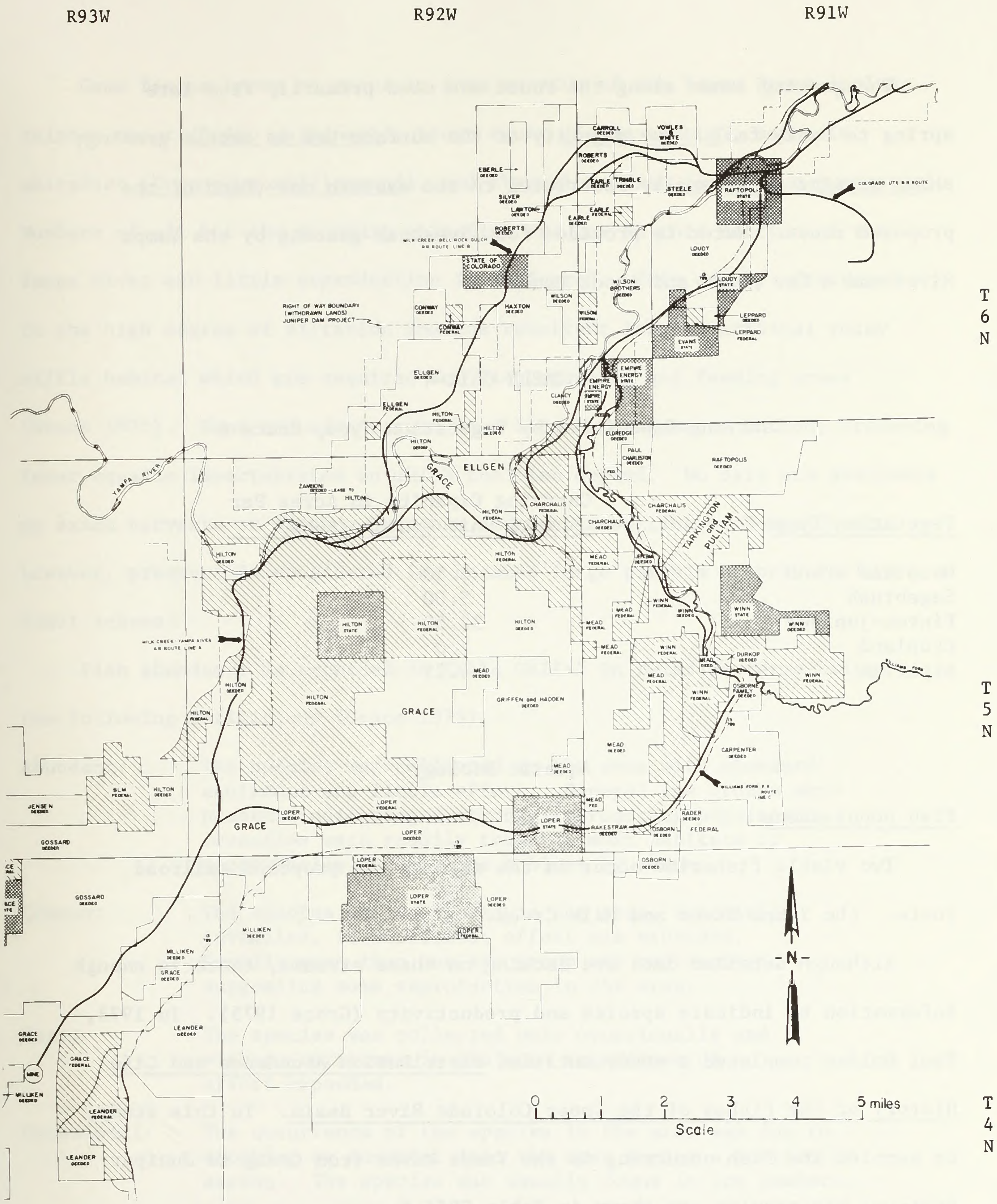


FIGURE GRII-8

Landownership along the proposed railroad and two alternates.

SOURCE: International Engineering Company Incorporated

The grazing lands along the route are used primarily from late spring to early fall. The majority of the surface use is cattle grazing; sheep grazing is generally restricted to the eastern one-third of the proposed route. Water is provided for livestock grazing by the Yampa River and a few ponds and stock tanks.

TABLE GRII-4

Carrying Capacities by Vegetation Type, Route A

Vegetation Type	Carrying Capacity in Acres Per Animal Unit Months (AUMs)
Mountain shrub	4.50
Sagebrush	5.00
Pinyon-juniper	32.50
Cropland	7.0
Riparian	4.25

Aquatic Biology

Fish populations

Two viable fisheries occur in the area of the proposed railroad route: the Yampa River and Milk Creek.

Although detailed data are lacking on these streams, there is enough information to indicate species and productivity (Grace 1975). In 1973, Paul Holden completed a study entitled Distribution Abundance and Life History of the Fishes of the Upper Colorado River Basin. In this study, he sampled the fish occurring in the Yampa River from Craig to Juniper Springs; his results are shown in Table GRII-5.

Game fishes known to occur in this section of the Yampa River include rainbow trout (*Salmo gairdneri*), brown trout (*Salmo trutta*), mountain whitefish (*Prosopium williamsoni*), and channel catfish (*Ictalurus punctatus*). Numbers of all but the mountain whitefish are low in this section of the Yampa River and little reproduction is indicated. This can be attributed to the high degree of siltation and the resultant loss of critical rocky riffle habitat which are required for fish spawning and feeding areas (Grace 1975). Sand and silt result in a less heterogeneous bottom, producing fewer aquatic invertebrates on which the fish depend. No data are available on exact harvests or fishing pressure along this section of Yampa River; however, pressure is considered low because large parcels of private land limit access.

Fish abundance is recorded in Table GRII-5 in relative terms using the following definitions (Grace 1975):

Abundant: The species was collected in the area with standard equipment and little effort. Several age groups were present indicating a strong, reproducing population. Juveniles were readily taken in most habitats or occasionally in only one habitat by seine.

Common: The species was collected in the area, especially juveniles, if sufficient effort was expended. Usually more than one age group was represented, suggesting some reproduction in the area.

Rare: The species was collected only occasionally and with no certainty in the area regardless of effort expended.

Occasional: The occurrence of the species in the area was due to stocking or movement into the area during a particular season. The species was usually found in low numbers.

TABLE GRII-5

Fish - Species Distribution and Abundance

Species	Yampa River	Williams Fork River
Salmonidae		
Rainbow trout Salmo gairdneri	0	0
Brown trout Salmo trutta	0	0
Mountain whitefish Prosopium williamsoni	A	A
Cyprinidae		
Roundtail Chub Gila robusta	A	C
Colorado squawfish Ptychocheilus lucius	R	–
Speckled Dace Rhinichthys osculus	C	R
Redside shiner Richardsonius balteatus	C	C
Fathead Minnow Pimephales promelas	C	C
Carp Cyprinus carpio	C	-
Catostomidae		
Flannelmouth sucker Catostomus latipinnis	C	C
Bluehead sucker Catostomus disebiolus	A	A
White sucker Catostomus commersoni	A	C
Ictaluridea		
Channel catfish Ictalurus punctatus	R	-
Cottidae		
Mottled sculpin Cottus bairdi	-	A

A = abundant; C = common; 0 = occasional; R = rare; – = not collected
SOURCE: Holden, 1973

The Colorado DOW stocks rainbow trout annually in areas of public access around Craig, which probably accounts for the presence of this species in areas further downstream. Brown trout are found in the area on a seasonal basis and in limited numbers; their presence and variation in age classes indicate some natural recruitment is occurring. Whitefish and channel catfish occur in the area as a result of natural recruitment; no data are available on age class distribution and growth in this section of the river. Holden indicates different age classes in these species, but he does not include a breakdown of classes.

Fish in Milk Creek were sampled by VTN biologists in August 1974; two sections of stream were electroshocked; no fish larger than three inches were collected, which is expected in a small, shallow stream high in sediment loads, warm in late summer, and with few places to spawn. The only fish identified were the redsie shiner (_Richardsonius balteatus_), speckled dace (_Rhinichthys nubilus_), fathead minnow (_Pimephales promelas_), and flannelmouth sucker (_Catostomus latipinnis_). This stream is not fished and only natural recruitment sustains the fish populations (Grace 1975).

Invertebrate populations

No data are available on the exact nature of the invertebrate populations in the Yampa River or Milk Creek. However, the presence of significant numbers of fishes, game and non-game species, would indicate a substantial, relatively diverse, invertebrate community.

Endangered species

Of particular importance to the proposed action is the pending consideration of the Yampa River as a "Critical Habitat" for the Colorado River

Squawfish (*Ptychocheilus lucius*). The recovery team for this species met in December, 1975 to decide if the Yampa River should be so designated; the results of that meeting are not yet available.

If the "Critical Habitat" criteria is established, then restrictions on any activity that could possibly impact the river become very stringent.

According to Colorado regulations, there are four endemic species classified as endangered, all of which presently or historically inhabitat the Yampa River. The species are: Colorado River Squawfish, humpback chub (*Gila cypha*), bonytail chub (*Gila elegans*), and humpback or razorback sucker (*Xyrauchen texanus*). Only the first two are on the Federal endangered fauna list, and as such are the only two covered by the Endangered Species Act of 1973.

Two recent inventories (unpublished) have identified the presence of the Colorado River Squawfish in the Yampa River as far upstream as Maybell (Seethaller-Utah State and Prewitt-CSU, 1975). The humpback sucker was also found in the Yampa River, approximately two miles up from its confluence with the Green River.

Squawfish were sampled in early August with ripe females and spent males present. Indications are that the squawfish spawned approximately a week earlier; however, no site specific data on spawning are available nor is the success of the spawning known. This information does put some broad parameters on spawning time in the Yampa River, for a period from mid-July to late August. The water temperatures were 68-70°F with no measurable turbidity.

The humpback suckers were found in the Yampa River during the fall and remained there until May. No specimens were noted during the summer and the significance of their absence during this period is not clearly understood at this time.

The habitat requirements for these four endangered species are similar. All four are known as "large river" forms, found only in the main channels of the Colorado, Green, and Yampa Rivers. Minckley and Deacon (1968) reviewed the status of native fishes in the lower Colorado River Basin (below the Grand Canyon) and concluded that "large river" forms are virtually extinct in the lower basin. Therefore the upper Colorado River basin including the Yampa River, remains the only refuge for these unique fishes (Holden and Stalnaker 1973). In general, these species require water temperatures from 68°-70° (20°-21°C) and high water clarity (i.e., low sedimentation or turbidity) for spawning. At present the Yampa below Craig remains clear except after rainstorms and spring runoff (Holden and Stalnaker 1973). Data indicate that squawfish move into the Yampa River from the Green River system as waters clear and warm to 68°-70°F, during July and early August. The assumed reason for this movement is spawning (Holden and Stalnaker 1973). The abundance of juvenile squawfish in lower Yampa Canyon has changed since 1968; small squawfish could be readily seined from several areas in lower Yampa Canyon in 1968, but very few were found in 1969 and none in many attempts in 1970. Whether the decrease in juvenile squawfish was natural or the result of increased sedimentation produced by the activities of man along or near the river is not clear. Nevertheless the Yampa River appears to be very important as a spawning habitat for Colorado squawfish and maintains a spawning population (Holden and Stalnaker 1973). Presence of the bonytail chub, the humpback sucker, and the humpback chub in the Yampa River is definitely important to fisheries scientists' knowledge and ability to preserve and maintain this species (Holden and Stalnaker 1973).

Cultural Components

Archaeological Resources

Dr. Joe Lischka, Colorado University, conducted an intensive cultural resource survey along both proposed and alternate railroad routes during June and July of 1975. In addition, Dr. Calvin Jennings, Colorado State University, completed an archeological reconnaissance survey of proposed coal lease areas for the BLM, also during the summer of 1975; this survey supplements Dr. Lischka's intensive survey. Eighty-three cultural sites were inventoried along both proposed and alternate routes; six additional sites occur in the general area of the proposed route. Figure GRII-9 shows approximate locations of these resources and Table GRII-6 indicates the nature of the resource. Forty-seven archeological sites lie along proposed Route A. Two sites, numbers 14 and 78 (see Table GRII-6), are eligible for nomination to the National Register of Historic Places.

Historical Resources

Table GRII-6 and Figure GRII-9 also indicate the nature and location of historical values adjacent to proposed and alternate routes. Thomas Iles' first ranch in Axial Basin is site no. 90. The ranch site apparently straddles Lots six and seven, Section 34, T.5N., R.92W. That portion of Lot six containing the ranch originally was patented to Thomas H. Iles on April 1, 1982. Mr. William H. Meadows first obtained a file certificate on July 27, 1885, for that portion of Lot seven in question; this was ultimately patented on April 17, 1889. Meanwhile the property was transferred to Thomas H. Iles on October 6, 1985.

Site no. 12 was the George Iles (son of Thomas Iles) homestead and is of no special significance. It was warranty deeded from the original homesteader, Herman Seilass (patented on September 25, 1914), to George Iles on April 25, 1914. This ranch was never solely owned by Thomas Iles.

TABLE GRII-6

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							Comments
				Archeologic					Historic		
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Structure	
1	x	x	x							1	
2	x	x	x						11		(Circa 1941-1961)
3	x	x	x	x							
4	x	x	x						2		
5	x	x	x	x							
6	x	x	x	x							
7	x	x	x	x							
8	x	x	x	x							
9	x	x	x	x							Recommended testing.
10	x	x	x	x							Recommended testing.
11	x	x	x	x							Recommended testing.
12	x	x	x						3		George Iles Ranch.
13	x	x	x	x							Recommended testing.
14	x	x			x			x			Recommended excavation--hence, eligibility for National Register nomination.
15	x	x		x							
16	x	x		x							No further action recommended.
17	x	x		x							
18	x	x			x						Recommended testing.
19		x							3		Two buildings are collapsed.
20		x		x							Recommended testing.
21		x		x							
22		x		x							

TABLE GRII-6 (Cont.)

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							
				Archeologic					Historic		
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Struc-ure	Comments
23	x			x							Recommended testing.
24	x						x				
25	x					x					
26	x					x					
27	x					x					
28	x			x							
29	x									1	Partial bldg. foundation.
30	x			x							
31	x			x							
32	x				x						
33	x			x							
34	x			x							
35	x			x							
36	x			x							
37			x					x			
38	x			x							
39			x					x			
40	x			x							Recommended testing.
41	x			x							Recommended testing.
42	x		x	x							
43	x		x	x							
44	x		x				x				
45	x		x						1		Abandoned mine shaft.
46	x		x	x							
47	x		x	x							

TABLE GRII-6 (Cont.)

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							
				Archeologic					Historic		
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Structure	Comments
48	x		x	x							
49	x		x	x							Recommended testing.
50	x		x	x							
51	x		x	x							
52	x		x	x							Survey in greater detail.
53	x		x				x				
54	x		x	x							
55	x		x	x							
56	x		x	x							
57	x	x	x	x							
58	x	x	x	x							Recommended testing.
59			x						4		
60	x		x	x							
61			x	x							
62			x			x					
63			x	x							
64			x	x							
65			x	x		x					
66			x								
67			x						4		Dugouts.
68			x	x							
69			x			x					More thorough investigation.
70			x			x					

TABLE GRII-6 (Cont.)

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site: Archeologic					Nature of Site: Historic		Comments
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Structure	
71			x	x							
72			x			x					Recommended testing.
73			x	x							More thorough investigation.
74			x	x							More thorough investigation.
75			x	x							More thorough investigation.
76			x	x							Recommended testing.
77			x	x							Recommended testing.
78			x				x				Recommended testing and excavation--hence, eligible for National Register nomination.
79			x	x							
80			x	x							
81			x	x							Recommended testing.
82			x	x							Recommended testing.
83			x	x							Recommended testing.
84							x				Located in general area.
85				x							Located in general area.
86				x							Located in general area.
87							x				Located in general area.
88								x			Located in general area.
89								x			Located in general area.
90									?		Thomas H. Iles Ranch site.

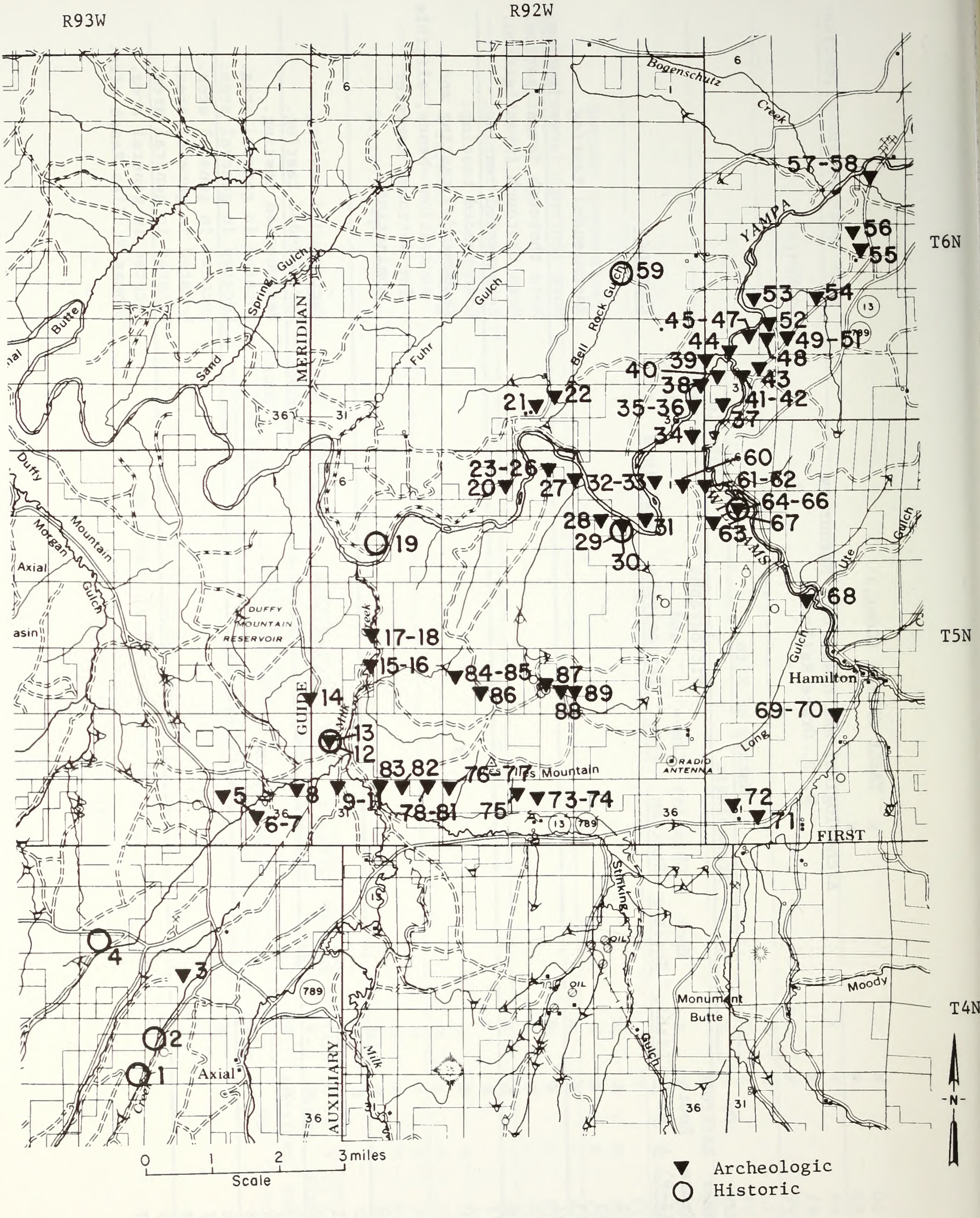


FIGURE GRII-9

Cultural resources adjacent to the proposed W.R. Grace railroad.

Aesthetics

The visibility of proposed and alternate rights-of-way for W. R. Grace Railroad is determined by public access routes -- in this area county, State, and U.S. highway systems. Portions of the proposed Route A and the alternate Routes B and C are visible from Moffat County Roads 17, 30, 32, 41, 45, 49, 51, 107 and 148 as well as from Colorado Highway 13 and U.S. 40.

A system developed for the Landscape Visibility study on the I-70 corridor through Colorado (Federal Highway Administration, Bureau of Land Management, and Colorado Division of Highways, 1974) provides an objective methodology for visual resource analyses. It enables a determination of the relative visibility of the many landscapes visible from the area's public roads. Refer to legend for landscape visibility maps (Figure GRII-11) and to Figure GRII-12 while tracing the following visual resource analysis methodology.

Any road traverses a visual corridor that consists of all areas visible from that road. This corridor can be divided into smaller landscapes or viewsheds that are defined by the ridges, peaks, and escarpments that surround these smaller landscapes. Though views may overlap from one viewshed to another, motorists naturally pass through successive viewsheds as they cross their respective topographic boundaries.

A single viewshed sequence is that segment of a road contained by any one viewshed. The transitional points between viewshed sequences, or viewshed sequence points, can be mapped to obtain reference points for classifying the landscape visible from each road segment.

Relative to each viewshed sequence, viewsheds may be subdivided into landscape visual units; these are determined by: (1) their distance from the viewer, (2) the combination of viewshed sequences offering the view, and (3) the direction of travel along these viewshed sequences. Each landscape visual unit's relative visibility may be mapped accordingly.

Borrowing from the art of landscape painting, views may be classified into three picture planes or distance zones:

1. Foregrounds include that portion of the view wherein human-size features are easily discernable, as are the four visual building blocks - form, line, color, and texture (i.e. visual dominance elements); they generally lie from one-quarter to one mile beyond the viewer;
2. Middlegrounds include larger-scale landscapes such as the three-dimensional quality of landforms and the patterns of cloud shadows. Overall patterns of vegetation and earth constitute texture which is no longer distinguishable in human-size features. Middlegrounds generally occur from the foreground limit up to 3-8 miles distant;
3. Backgrounds include distant landscapes where colors and texture are subdued. These landscapes often appear as silhouettes though some vegetative and geologic patterns are visible up to 20 miles.

Mapping symbols are used to identify each visual unit's relative visibility as indicated above. Though any one visual unit may be viewed from more than one viewshed sequence and therefore at varying distances, map symbols indicate its most sensitive level of exposure to the viewer.

Analysis of the landscape visibility maps will suggest areas more visible than others. Visibility increases at closer distances, when both number and length of viewshed sequences offering the view increase, and when the unit can be viewed by motorists traveling in both directions.

Refer to Chapter IV of the Regional Analysis for a discussion of the regional aesthetic setting in the area of the proposed railroad as well as a general discussion of visual resources.

Four landscape visibility maps have been prepared to illustrate relative visibility of the one proposed and two alternate railroad routes as addressed in W. R. Grace's feasibility study (see index to Landscape Visibility Maps in Figure GRII-10). Three maps, at a scale of one inch/mile (Figures GRII-12, GRII-13, and GRII-14) indicate overall visibility for all three routes. One additional map in greater detail was prepared to show visibility more clearly near the area proposed for loadout facilities at the proposed railroad terminus (Figure GRII-15).

Viewshed sequence points were lettered alphabetically beginning northbound on the Bell Rock Gulch road, Moffat County Road 30 (see Figure GRII-14). Immediately south of the confluence of Yampa and Williams Fork Rivers, southbound on Colorado Highway 13, this alphabetical lettering sequence was repeated (see Figure GRII-12). Alphabetical lettering sequence was begun a third time, still southbound on Colorado Highway 13, south of Iles Mountain (see Figures GRII-13 and GRII-14). Care should be taken not to confuse viewshed sequences having the same alphabetical lettering; to help clarify, note the contour alinement and resultant topographic exposure of landscape visual units.

Eleven additional figures, GRII-16 through GRII-26, illustrate key points on the proposed Route A. Figure GRII-1 is an aerial oblique photograph that shows the steep hillside that would be traversed by proposed Route A. Figure GRII-22 shows the same hillside as seen from the river.

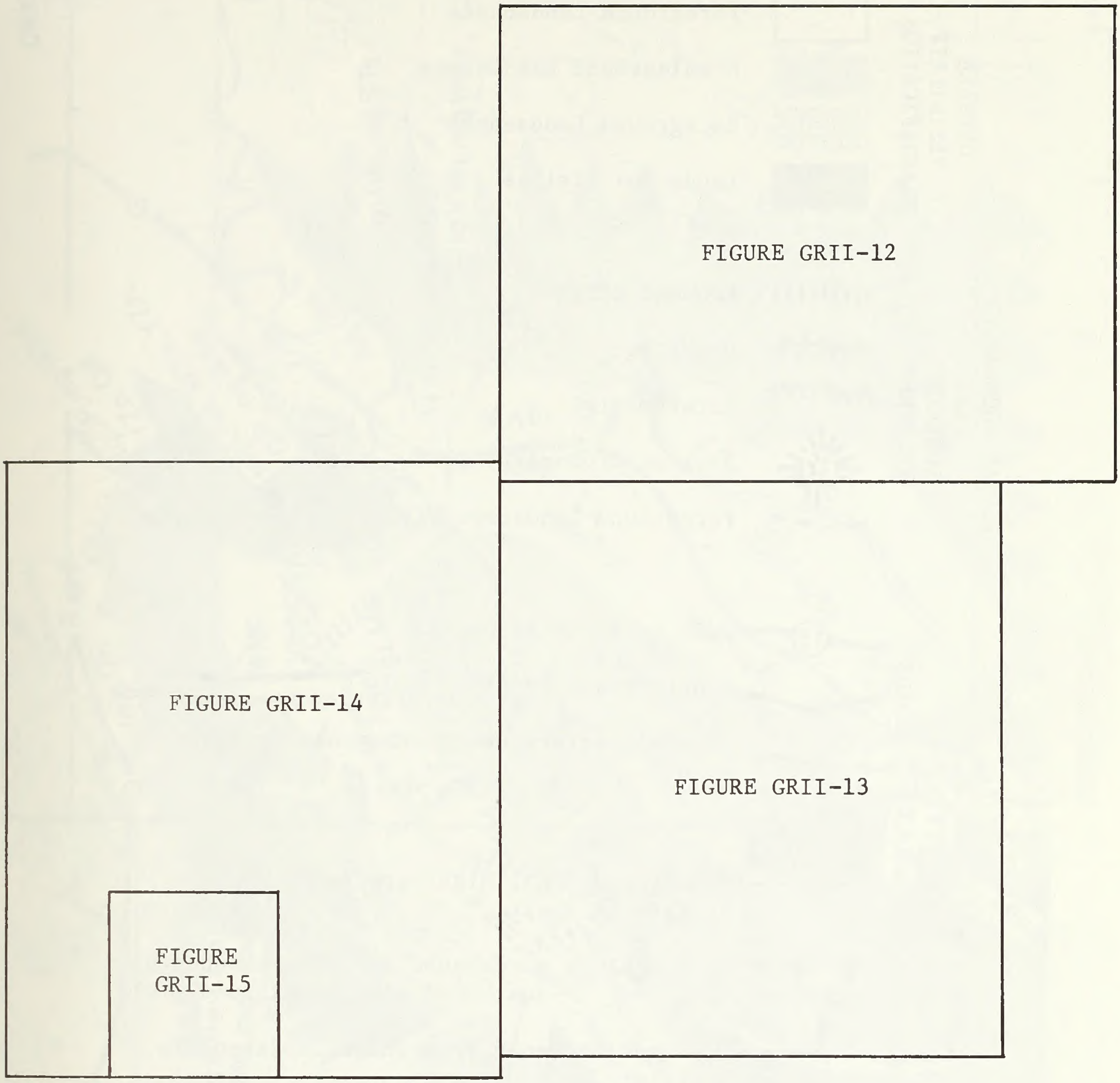


FIGURE GRII-10

Index to landscape visibility maps for W.R. Grace railroad.

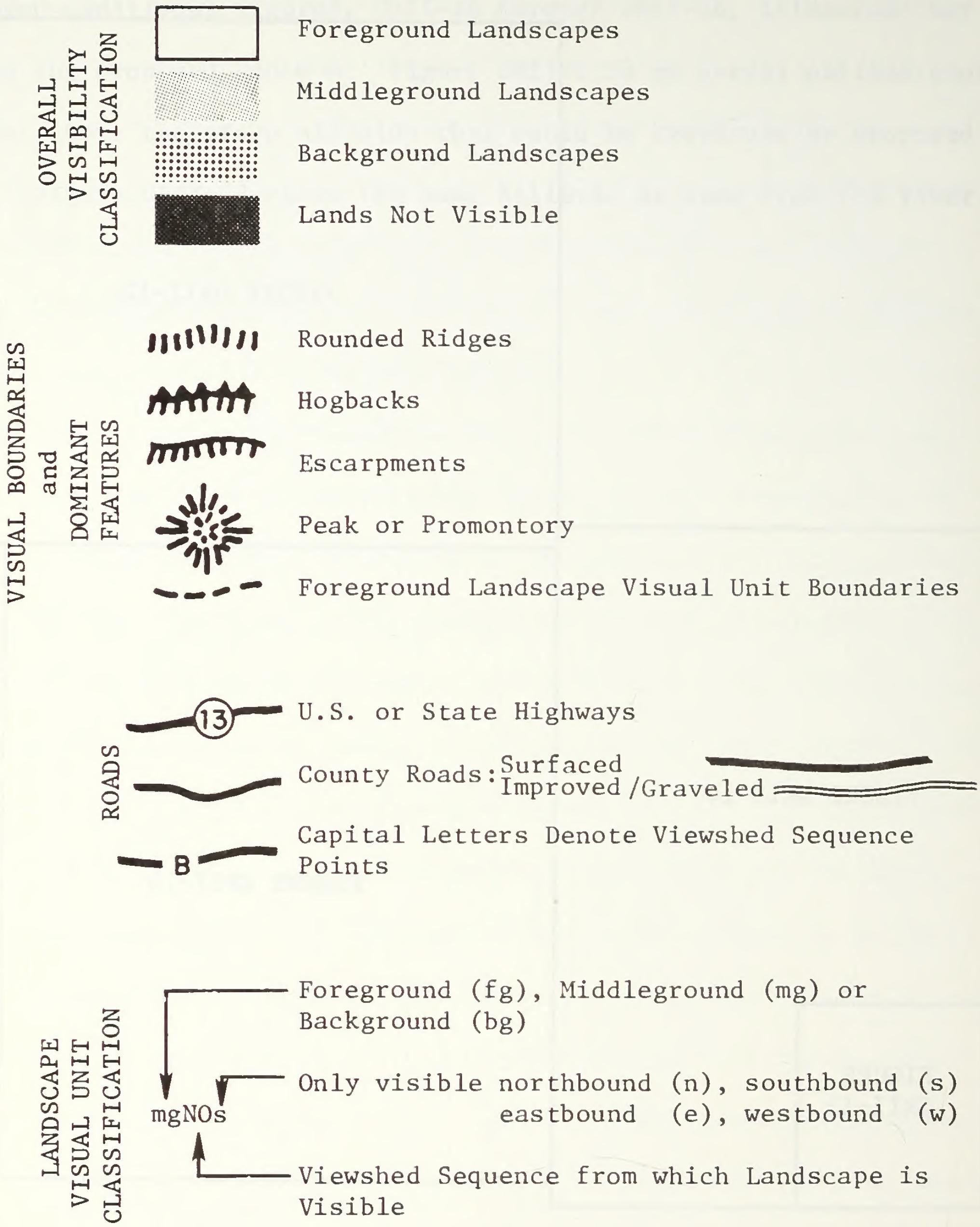

OVERALL VISIBILITY CLASSIFICATION
Foreground Landscapes
Middleground Landscapes
Background Landscapes
Lands Not Visible
VISUAL BOUNDARIES and DOMINANT FEATURES
Rounded Ridges
Hogbacks
Escarpments
Peak or Promontory
Foreground Landscape Visual Unit Boundaries
ROADS
13
U.S. or State Highways
County Roads: Surfaced
Improved /Graveled
B
Capital Letters Denote Viewshed Sequence Points
LANDSCAPE VISUAL UNIT CLASSIFICATION
mgNOs
Foreground (fg), Middleground (mg) or Background (bg)
Only visible northbound (n), southbound (s) eastbound (e), westbound (w)
Viewshed Sequence from which Landscape is Visible

FIGURE GRII-11

Legend for landscape visibility maps.

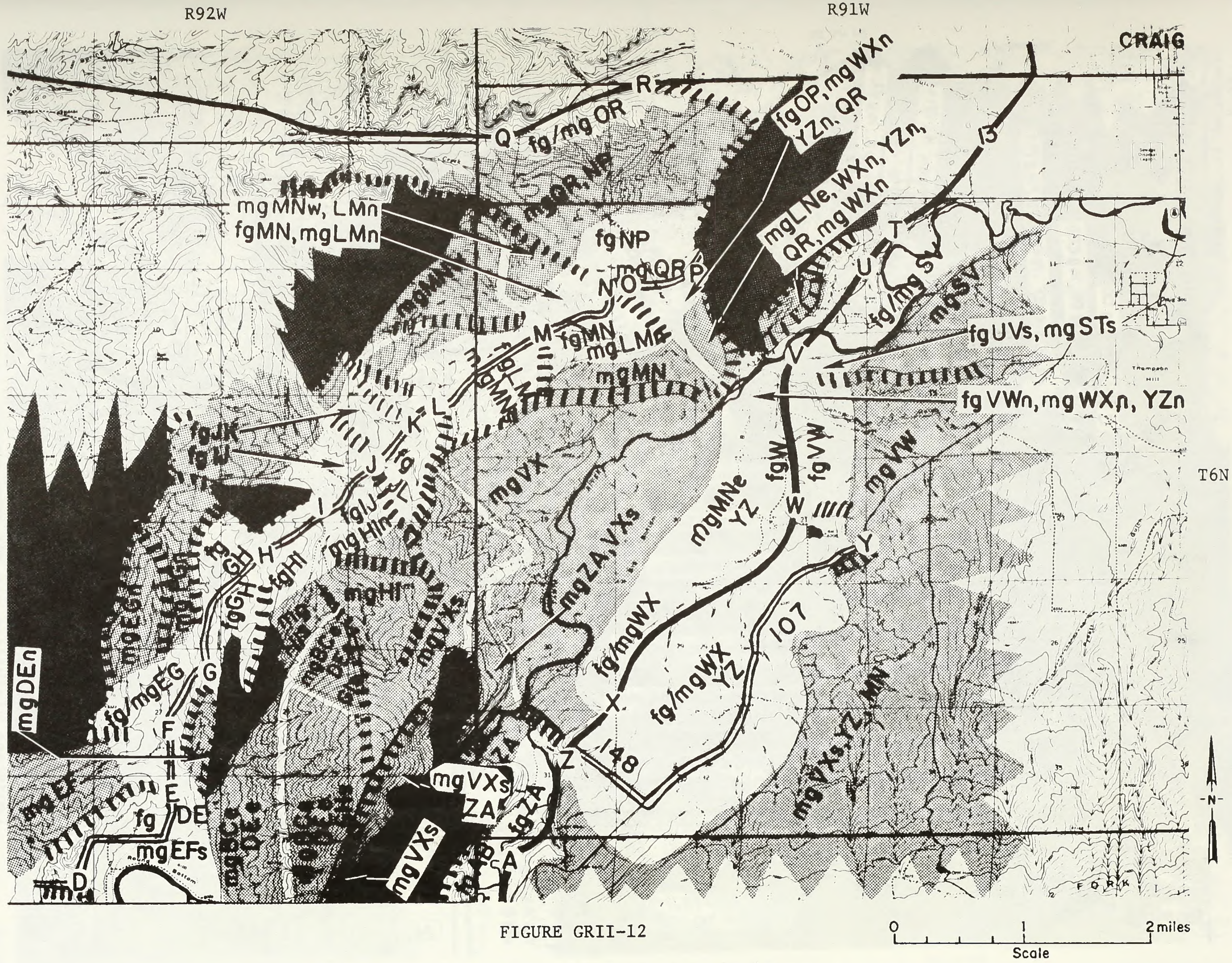


FIGURE GRII-12

Landscape visibility map for W.R. Grace railroad.

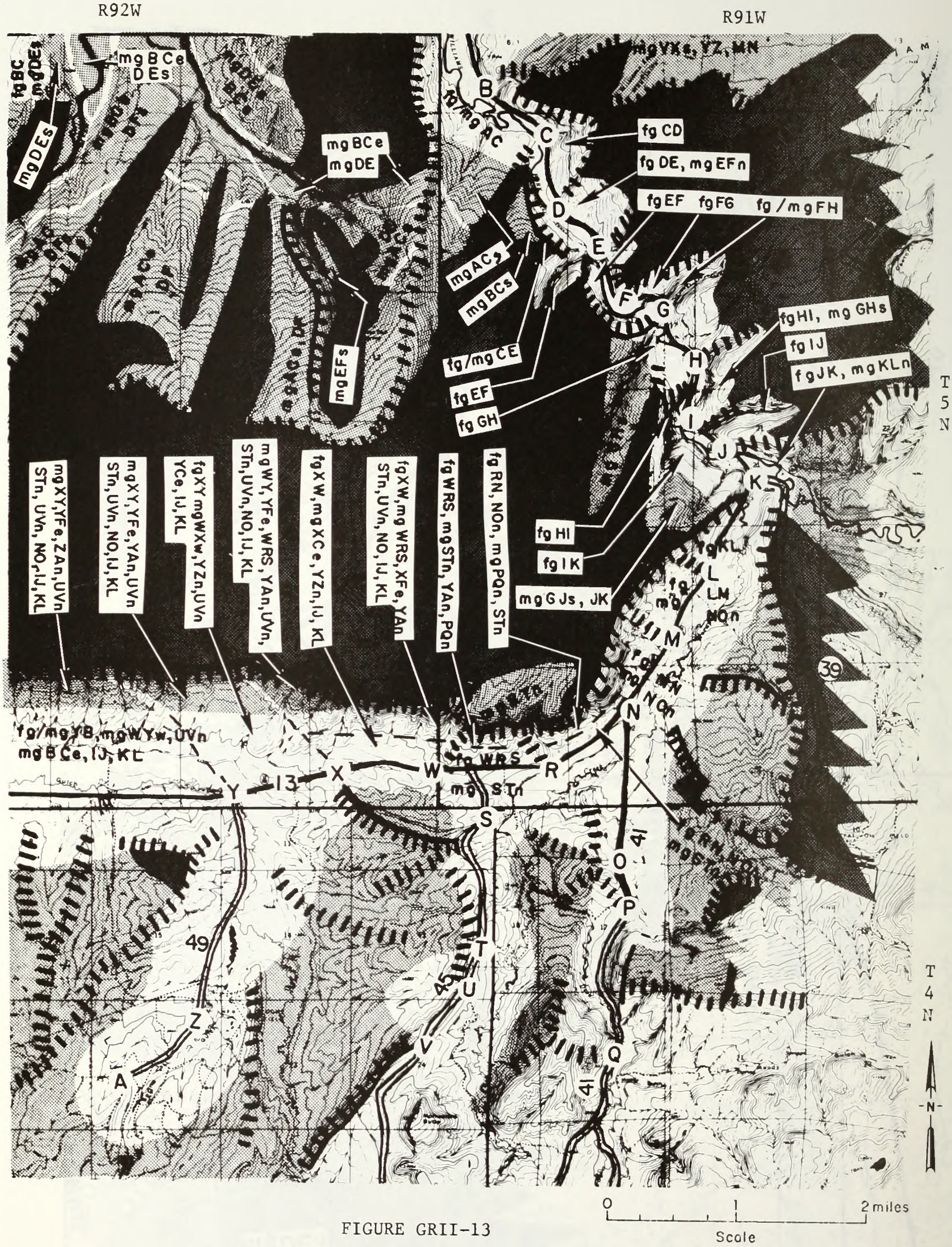
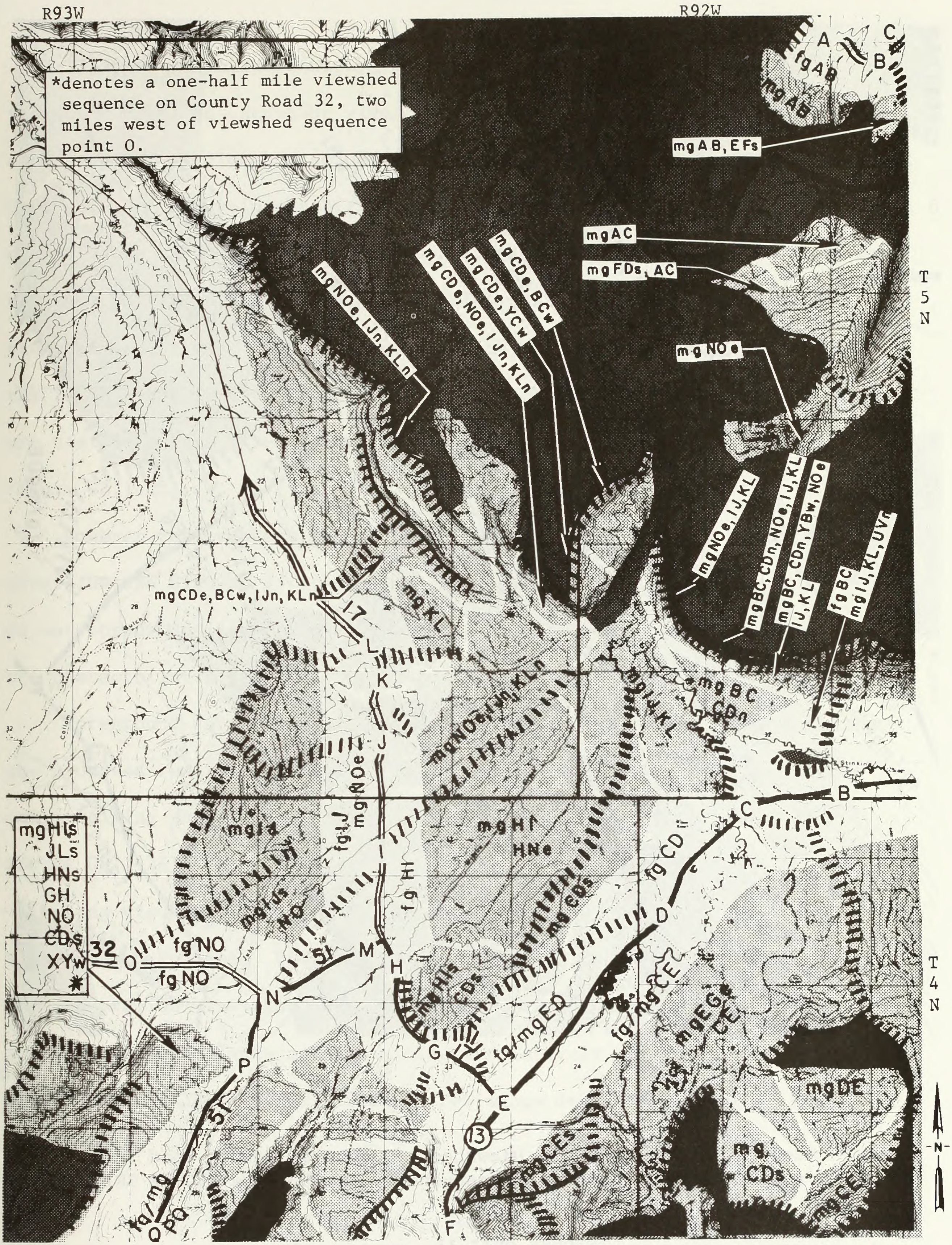


FIGURE GRII-13

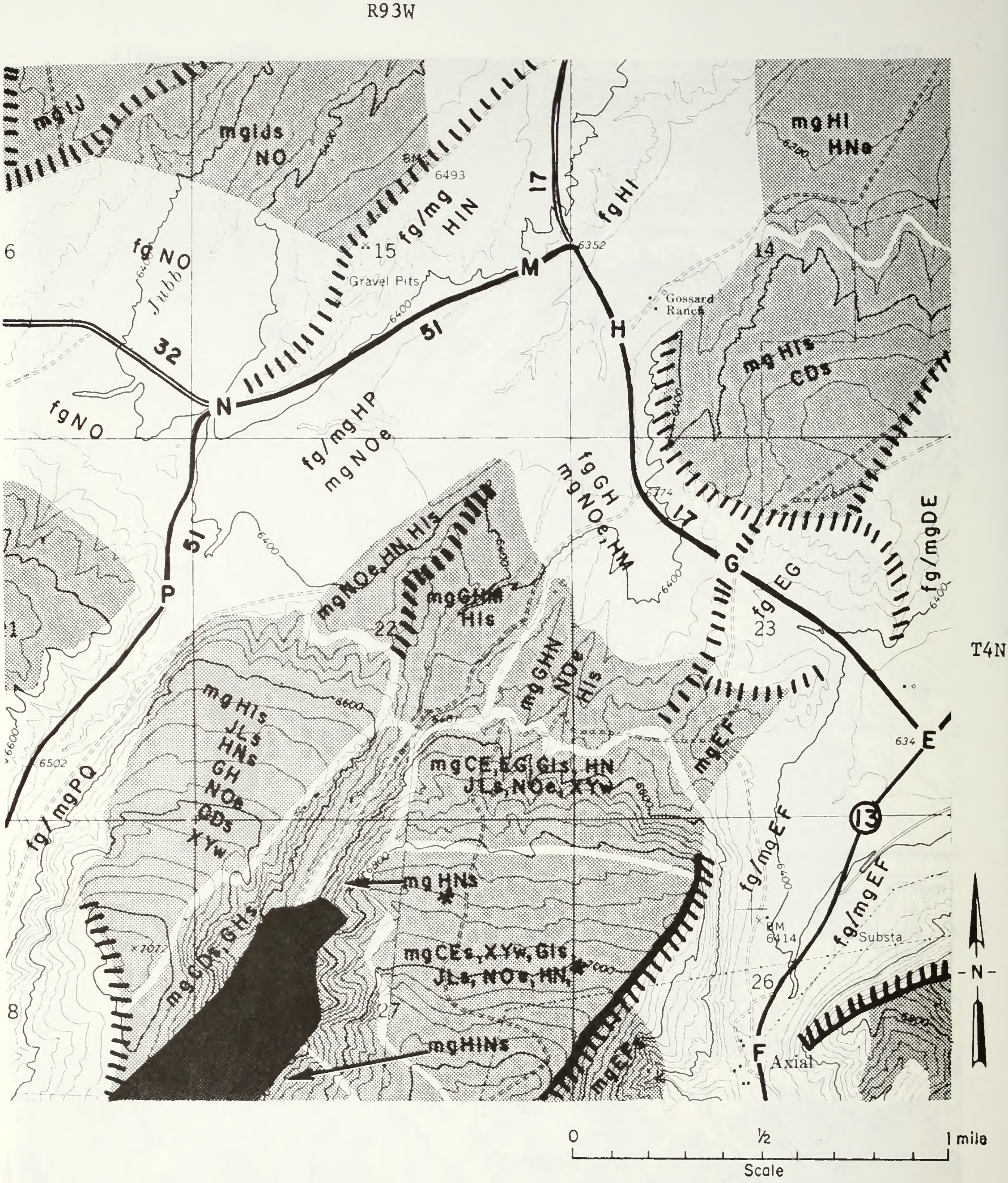
Landscape visibility map for W.R. Grace railroad.



*denotes a one-half mile viewshed sequence on County Road 32, two miles west of viewshed sequence point 0.

FIGURE GRII-14

Landscape visibility map for W.R. Grace railroad.



*denotes a one-half mile viewshed sequence on County Road 32 two miles west of viewshed sequence point O, (see FIGURE GRII-14).

FIGURE GRII-15

Landscape visibility map for W.R. Grace railroad.

The most visually sensitive portions of the proposed route would include foreground landscape visual units along Colorado Highway 13; these can be seen from viewshed sequences UV through ZA (see Figure GRII-12). Pastoral landscapes in the Big Bottom area, and rolling sagebrush types characterize these units. Two ranches lie immediately adjacent to viewshed sequence WX. Mixed foreground and middleground landscapes visible from viewshed sequence VW reveal a powerline and pumping station adjacent to the Yampa River. Recent road building and other construction activities are visible at the site of the new Colorado Ute generating plant (see Figure GRII-12).

However the greatest minus deviations have resulted from both the powerline and Highway 13 itself. These are minus deviations because they do not borrow dominance elements (i.e. form, line, color, and texture) from the characteristic landscape.

Foreground units also lie adjacent to County Roads 17, 32, and 51 near the proposed railroad terminus. Few minus deviations occur in this typically rolling sagebrush landscape containing scattered farm lands (see Figure GRII-26).

Less visually sensitive middleground landscape visual units are also traversed by Route A. Viewshed sequences AB, BC, DE, and EF on County Road 30 provide views into the Round Bottom area. This area consists of a somewhat enclosed landscape containing a relatively greater amount of topographic and vegetative variety. Few minus deviations occur in these visual units.

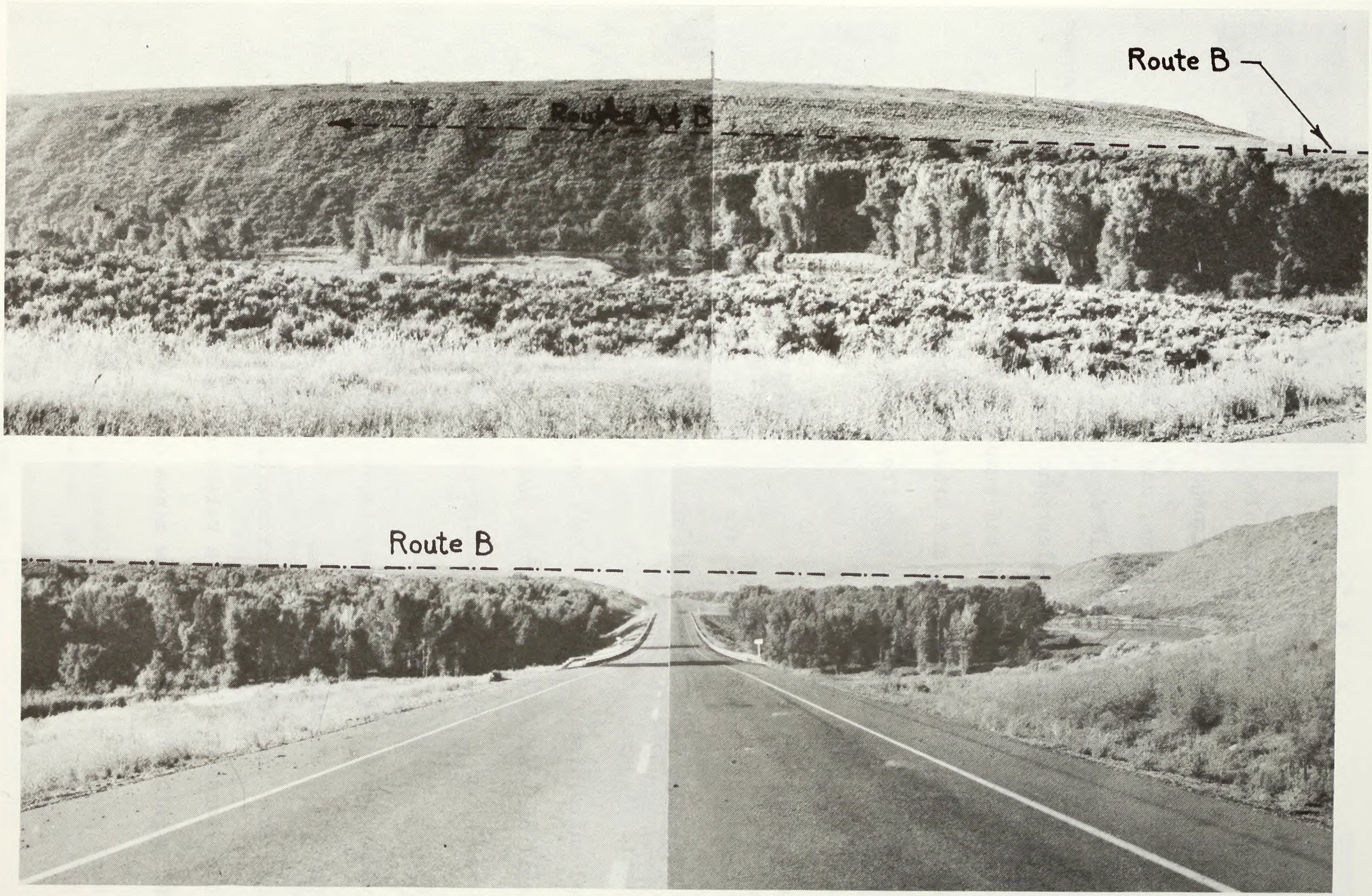


FIGURE GRII-16

Views to the proposed Colorado-Ute railroad spur and the beginning of the proposed W. R. Grace Railroad (top photo) are available to southbound Colorado 13 motorists on viewshed sequence UV. Alternate Route B would cross the Yampa River to the right of the highway beyond the bridge (lower photo).

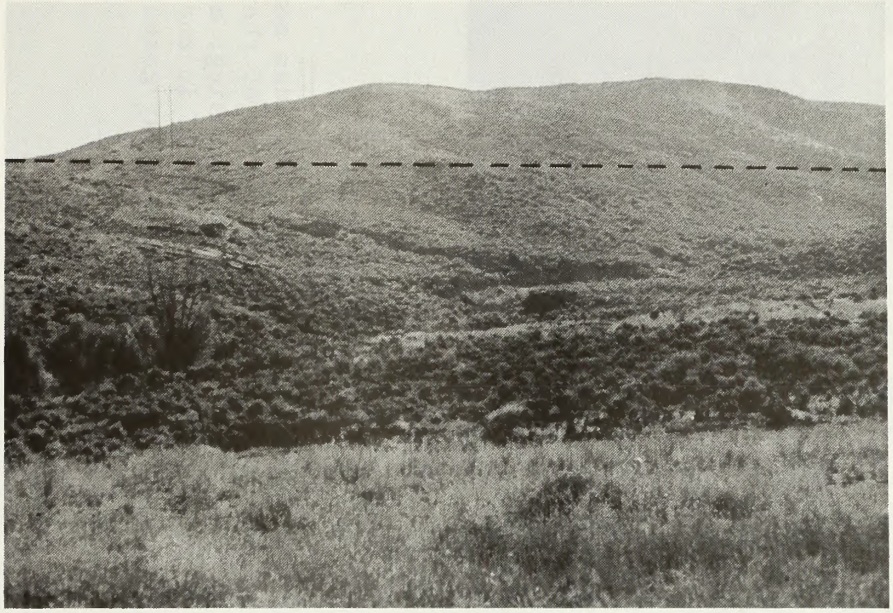
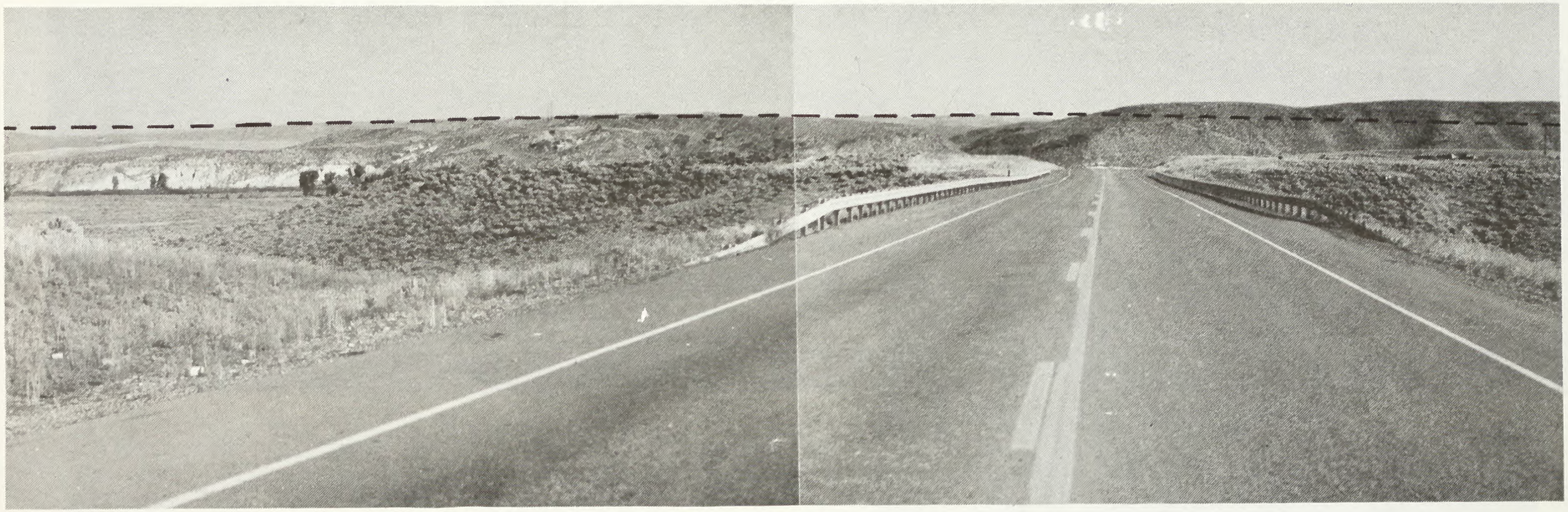


FIGURE GRII-17

Looking east from viewshed sequence VW on Colorado 13, motorists can view the area of a proposed 90 foot high fill on proposed Route A in the foreground.



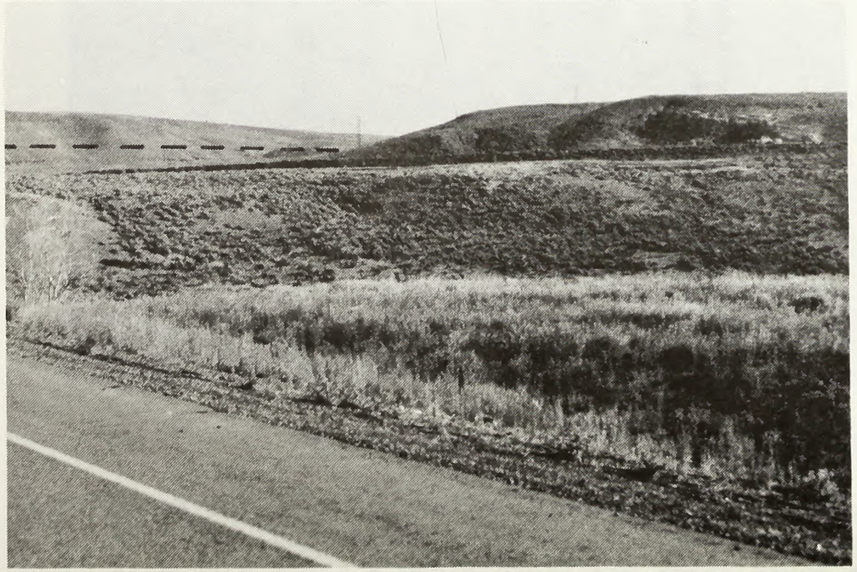


FIGURE GRII-18

Viewshed sequence VW also provides northbound motorists with this view of the proposed Route A railroad crossing; a 75 foot high fill would be placed in the draw immediately left of the highway guard rail.

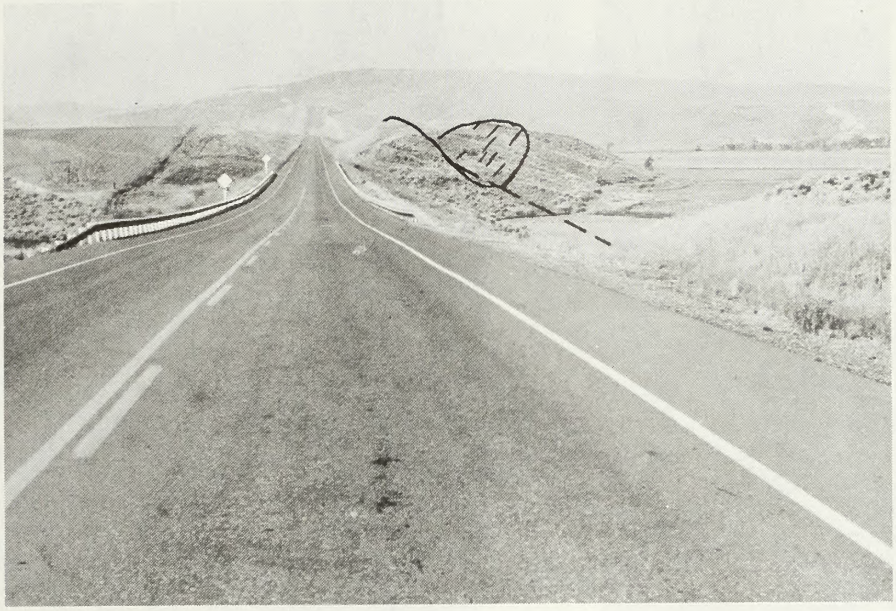


FIGURE GRII-19

The proposed Route A would result in a 60 foot deep cut into the hillside immediately right of the highway in the foreground; this view from viewshed sequence WX can be seen by southbound motorists on Colorado 13.

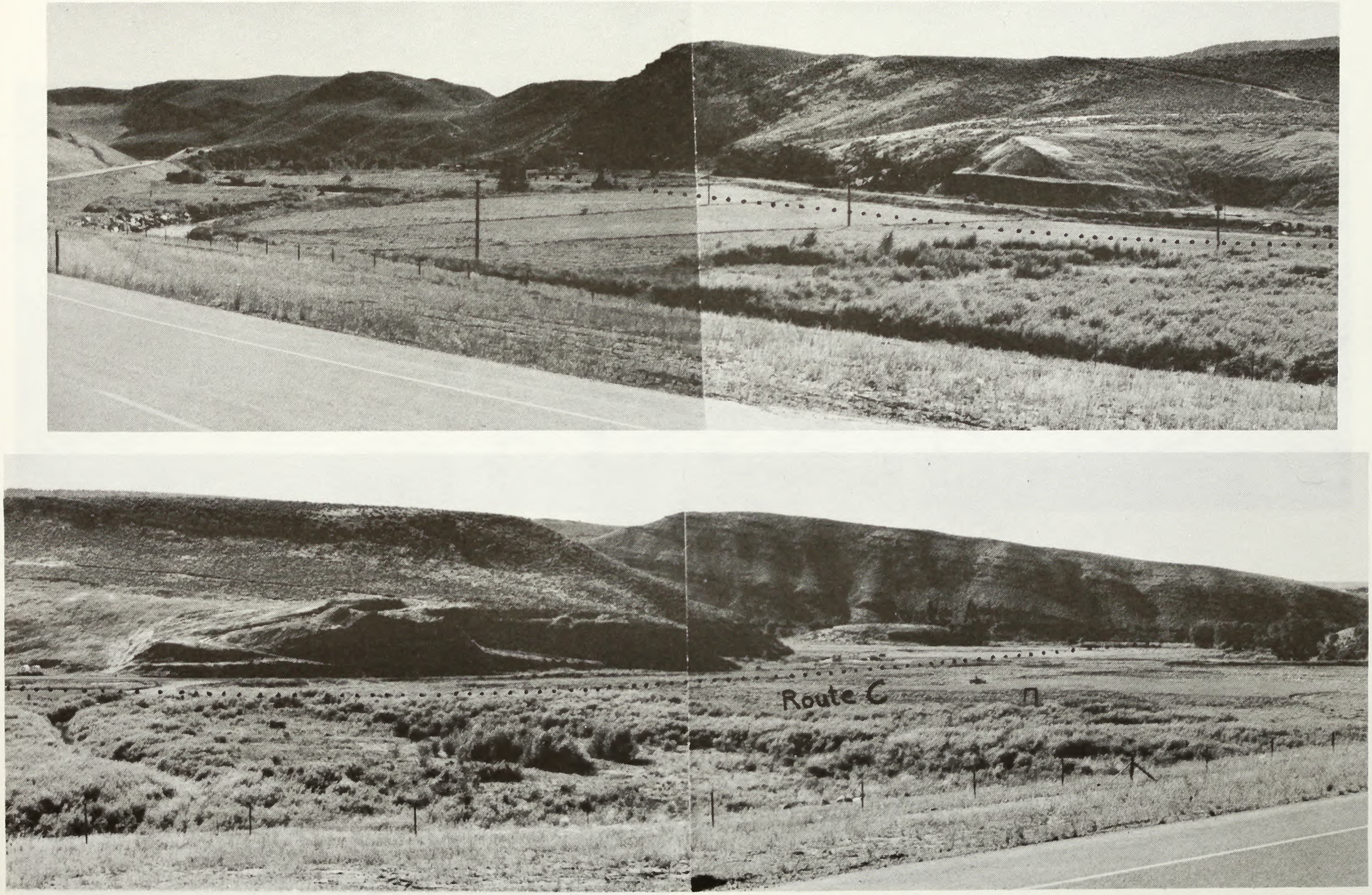


FIGURE GRII-20

Viewshed sequence ZA, adjacent to the Wise Hill 5 underground mine (formerly Selingo), provides this panorama of a rather enclosed landscape. The lower photo contains the proposed Route A crossing of the Williams Fork River. Alternate Route C would parallel the base of the hill opposite the river (top photo).

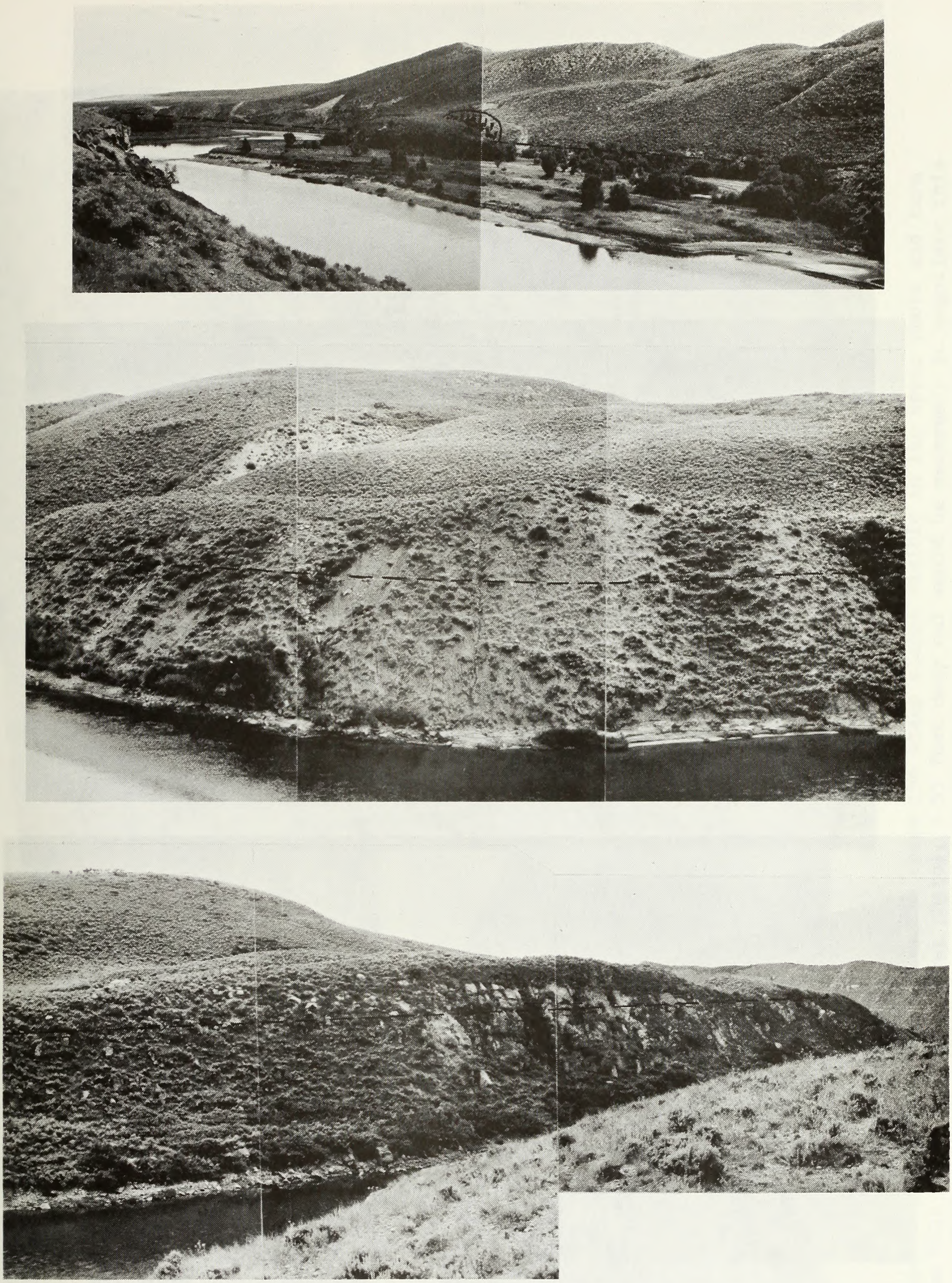


FIGURE GRII-21

Looking south at milepost A-6 adjacent to proposed Route A, this three-piece panorama shows the terrain that must be negotiated if this route is constructed.

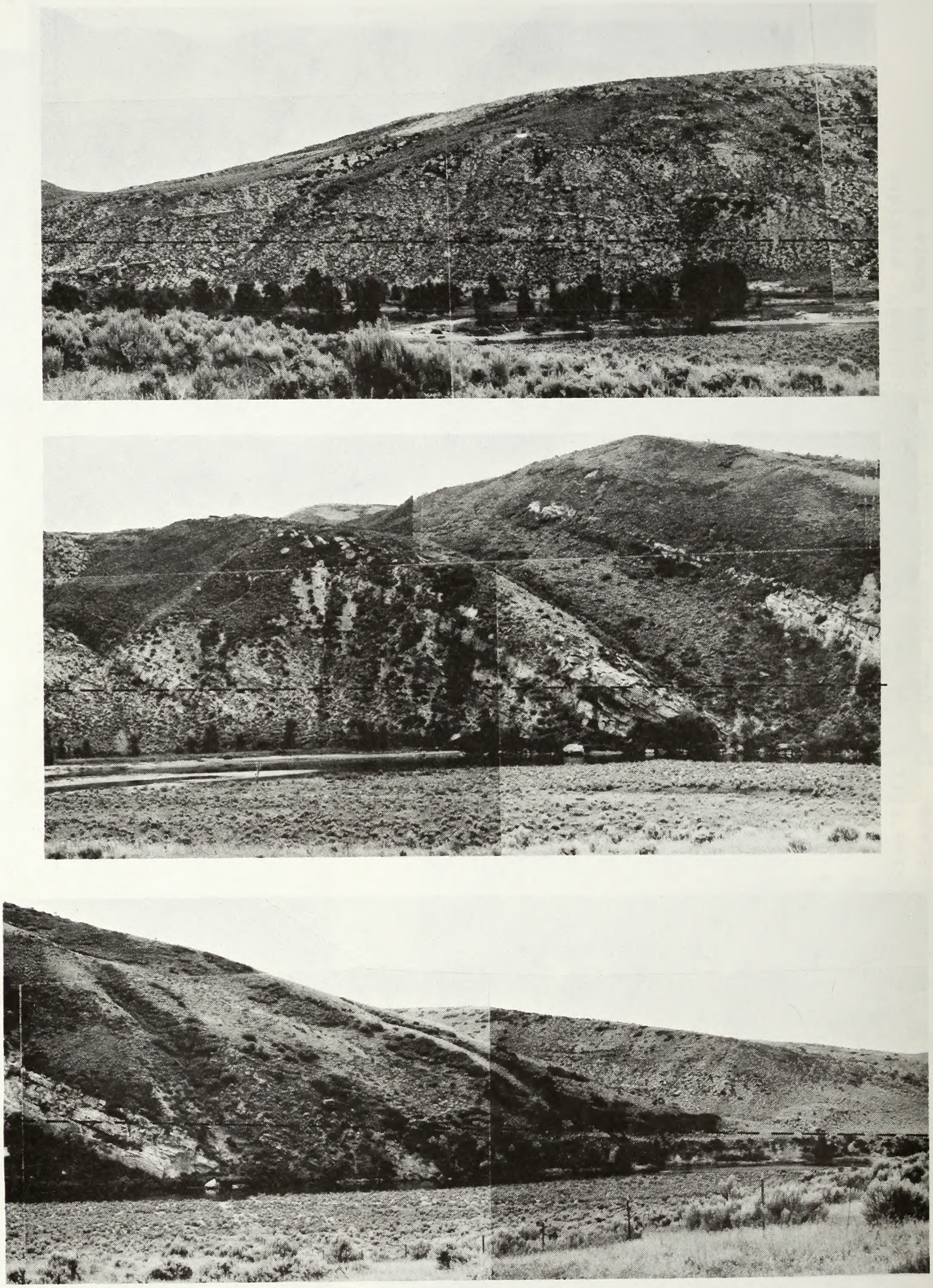


FIGURE GRII-22

Near milepost A-8 proposed Route A traverses these steep rock outcrops; one 50 foot and two 70 foot deep cuts would occur in this landscape visual unit. These are visible as foreground only from the river, but appear as middleground from County Road 30.

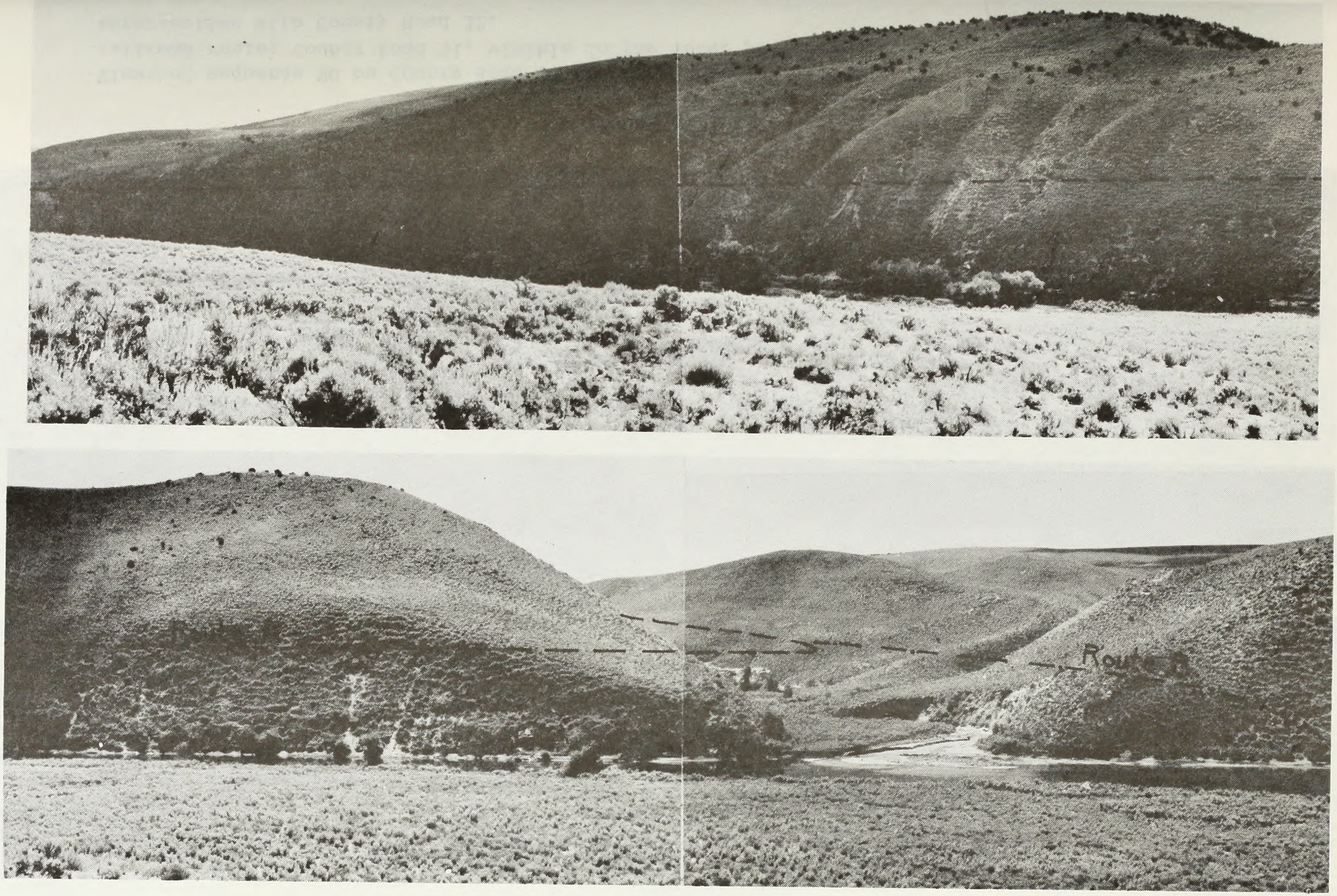


FIGURE GRII-23

The proposed alinement of Route A would cross the steep slopes visible in the upper photo and turn into the Milk Creek drainage (lower photo). A 55 foot deep cut would be necessary to negotiate this turn; the Milk Creek bridge would be 65 feet high. Alternate Route B would cross the Yampa River on a bridge of equal height, also visible in the lower photo.

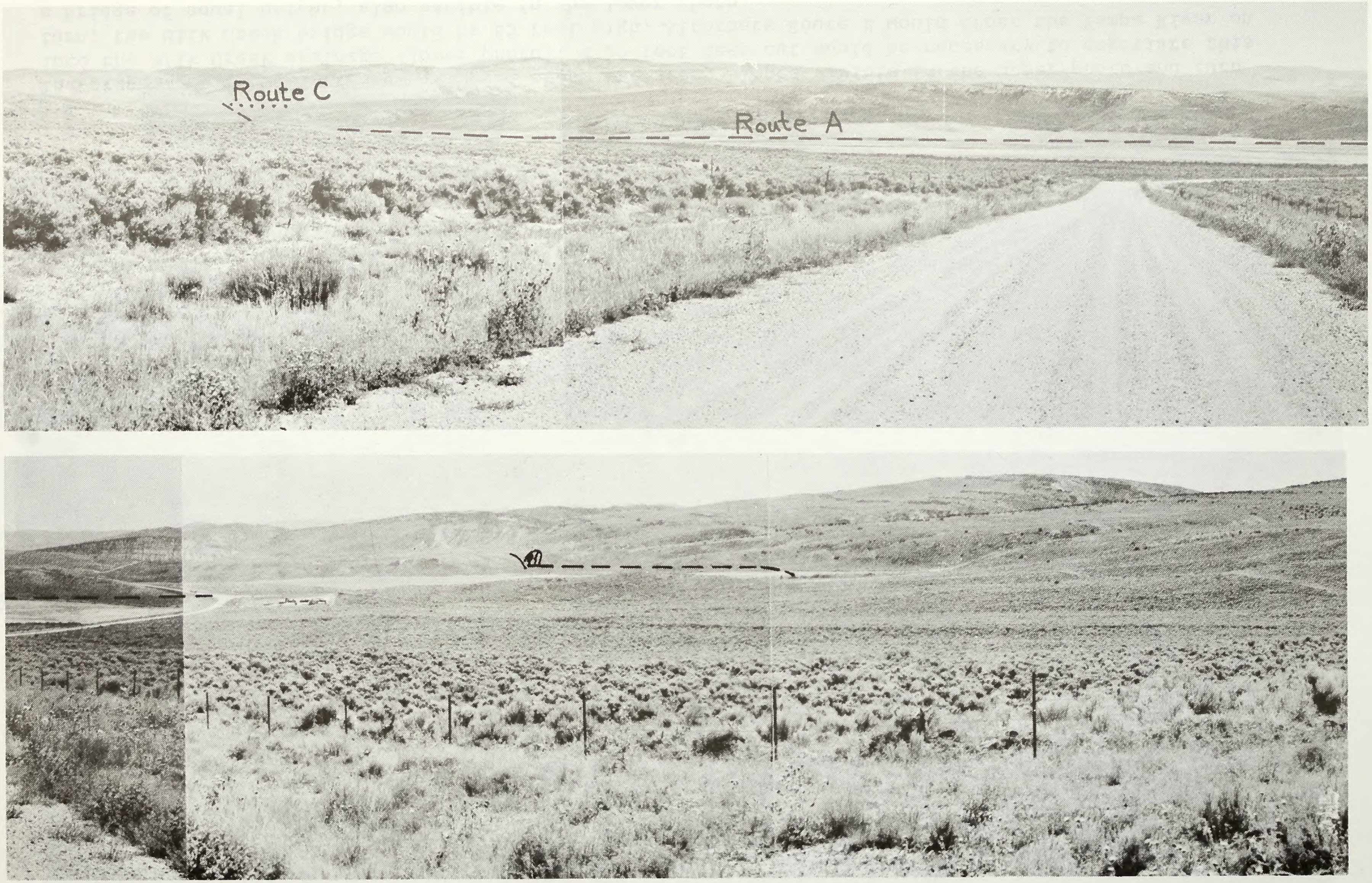


FIGURE GRII-24

Viewshed sequence NO on County Road 32 provides this east-looking view of the proposed railroad route; County Road 51, visible in the lower photo, would be crossed near its intersection with County Road 32.

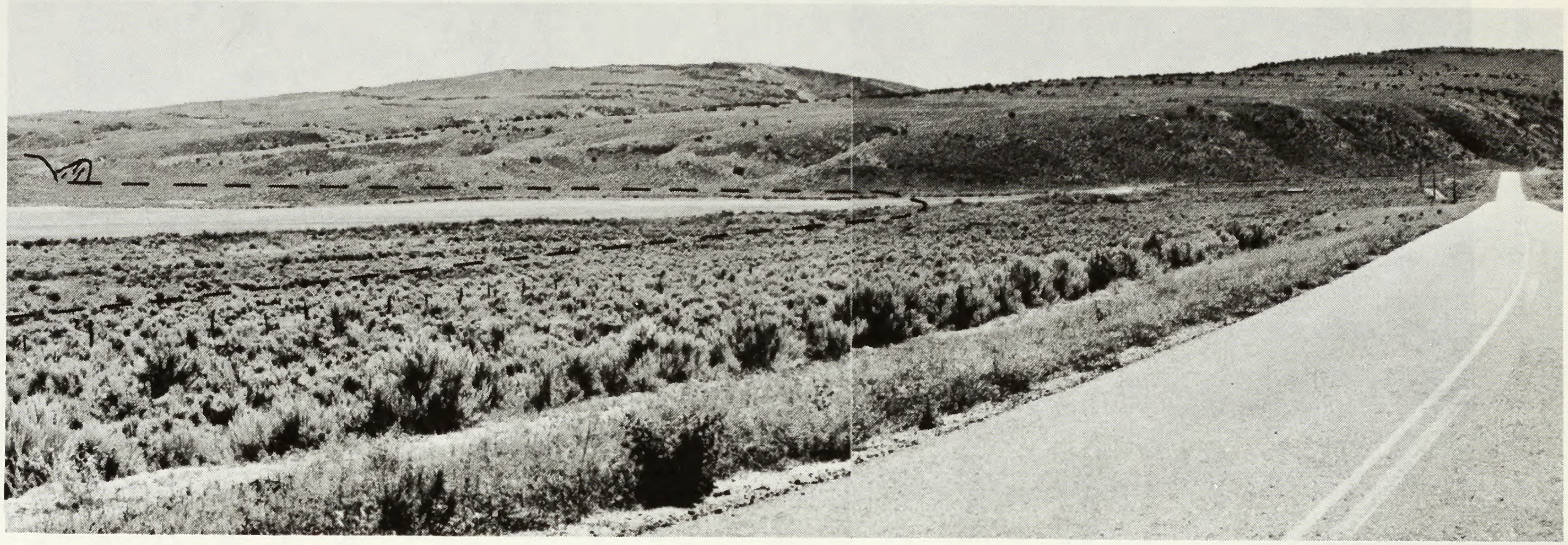


FIGURE GRII-25

The proposed railroad alinement parallels County Road 51 at viewshed sequence NP, then turns left at the base of the distant sagebrush hill. It cuts through the small ridge (see left side of photo) before entering the loadout area in Taylor Creek Canyon.

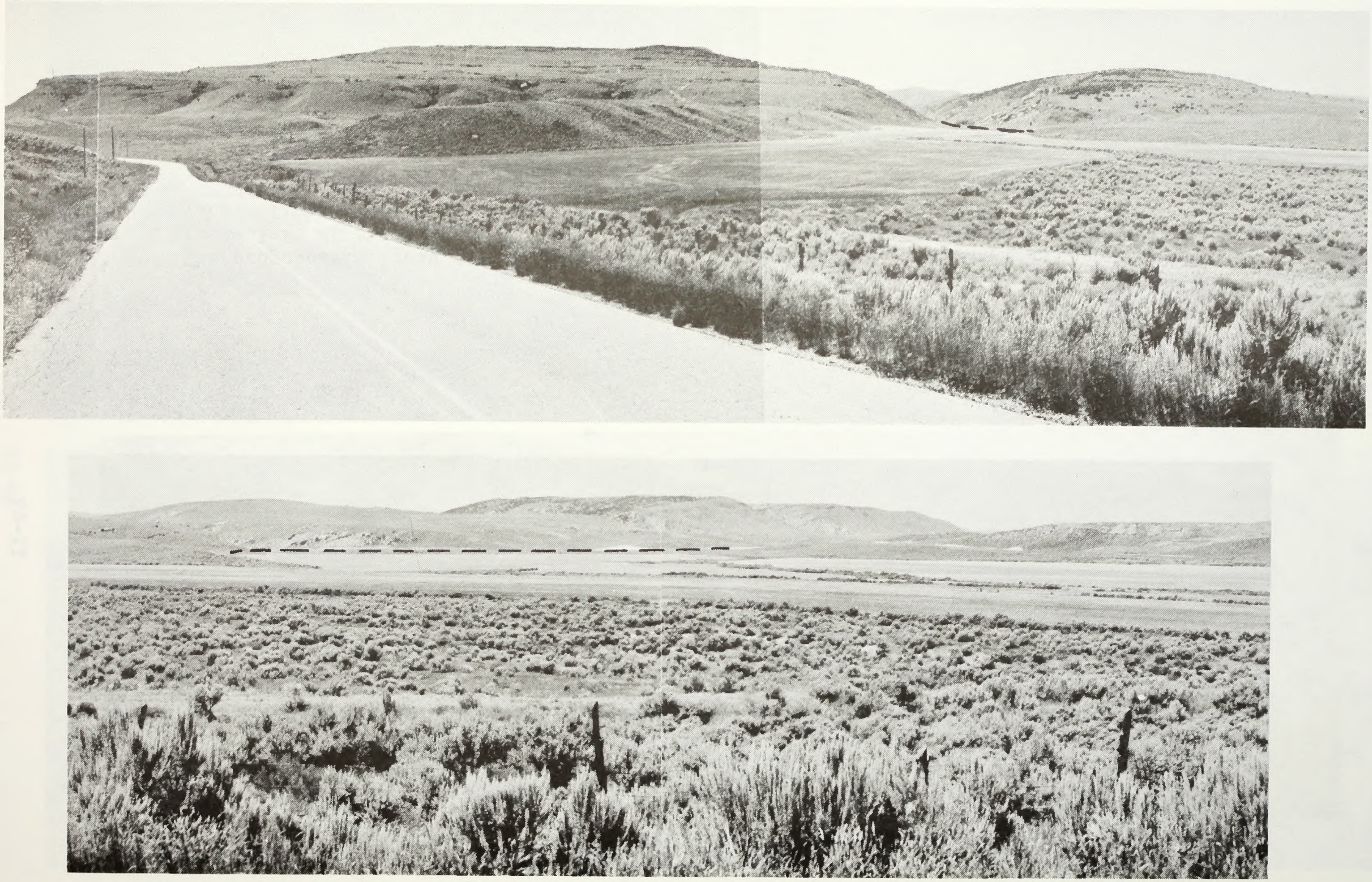


FIGURE GRII-26

This four-photo sequence from County Road 17 on viewshed sequence HG looks south towards Taylor Creek; the proposed railroad alinement is visible in the middleground in both photos.

Middleground landscapes also provide visual access to the proposed Williams Fork River crossing on Route A; this can be viewed from viewshed sequence ZA on Colorado Highway 13 (see Figure GRII-12 for landscape visibility map and Figure GRII-20 for photos illustrating the view from sequence ZA). Sequence ST on Colorado 13 also provides visual access to middleground units containing the beginning of the route.

After the route emerges from Milk Creek Canyon it would enter both foreground and middleground landscapes that can be viewed from viewshed sequences NO (County Road 32), IJ, and KL (County Road 17) as can adjacent foreground units.

The route would also traverse middleground landscapes where it would enter Taylor Creek drainage; this portion is visible from viewshed sequences along County Roads 17, 32, and 51. The route would not traverse any background landscapes. No portion of the route in Milk Creek Canyon could be viewed from any public road.

If the proposed Juniper Reservoir is constructed (see Regional Analysis, Chapter IV) additional foreground landscapes would be created along ten miles of the route from the Yampa River's confluence with the Williams Fork River to its confluence with Milk Creek, otherwise known as Little Yampa Canyon. Continual visual access to this portion of the route would be provided to recreational boaters on the Yampa River (or future reservoir) from approximately nine viewshed sequences. All ten miles of the route proposed for this area would traverse foreground landscapes if the proposed reservoir becomes a reality (see Figure GRII-21, 22, and 23).

Traffic volume data are available only for Colorado Highway 13 and U.S. Highway 40. Average Daily Traffic (ADT) counts for the past nine years are found on Table GRII-7. All five sampled highway segments experienced an overall increase from 1965-1974. U.S. Highway 40 experienced a smaller increase than any segment of Colorado Highway 13; and the most southerly segments of Colorado 13 experienced the greatest increases. The portion of Colorado 13 that parallels the route has consistently experienced greater increases from 1970-1974 than from 1965-1970.

Estimation of potential boating use on the proposed Juniper Reservoir is possible through analyzing use at a comparable sized reservoir, with similar climatic conditions, with similar shoreland unit capabilities, and at similar distances from metropolitan population centers. Curecanti National Recreation Area in Gunnison County, Colorado, meets these requirements; during the 1974 season 42,975 boating visits were recorded on Curecanti's Blue Mesa Reservoir. Similar visitation may be expected at Juniper Reservoir. This would equal an average daily boating use of 175 visits, assuming an eight-month ice-free boating season. An unknown portion of this estimate would have visual access to the ten mile segment of Little Yampa Canyon proposed to be traversed by the railroad. (Visitor-use estimates based on surface acreage were not used as this would reflect the recreation carrying capacity which would only be realized under optimum conditions).

Recreation

Refer to Chapter IV of the Regional Analysis for a discussion of the existing recreation environment; the following paragraphs outline recreation resources more specifically as well as their current use in the area of the proposed railroad.

TABLE GRII -7

Average Daily Traffic (ADT) Volumes

Sampling Segment	Sampling Year	ADT	Average Annual Increase(%) 1/	
			2/	3/
U.S. 40 West of Craig	1965	1,500	.66	1.73
	1970	1,550	3.08	
	1974	1,750		
Colorado 13 South of Craig	1965	1,150	5.46	3.00
	1970	1,500	0.00	
	1974	1,500		
North of Hamilton	1965	700	-0.29	3.69
	1970	690	8.89	
	1974	970		
South of Hamilton	1965	650	0.61	3.68
	1970	670	7.66	
	1974	900		
North of Ninemile Gap	1965	380	2.50	7.52
	1970	430	14.15	
	1974	730		

1/ compounded annually.
2/ average annual increase between sampling years.
3/ average annual increase for nine-year period.

SOURCE: Colorado Division of Highways, Traffic Volume Maps; 1965, 1970, and 1974.

Resources

Especially significant autumn and winter big game concentrations (largely deer and occasional elk) occur adjacent to Colorado Highway 13 between its intersection with County Roads 49 and 148. Significant viewing opportunities also occur in Little Yampa Canyon southwest of Craig.

Privately-owned acreage lying between national resource lands and public access routes largely precludes public hunting. However, hunting access to Duffy Mountain is maintained via County Road 17. A solid block of public land extends to Iles Mountain and does allow for walk-in hunting though no road access is available across Milk Creek. See Regional Analysis, Chapter IV, for hunting use statistics.

A small yearlong antelope herd is found in the Bell Rock Gulch area southwest of Craig; County Road 30 provides visual access to this area for wildlife viewing.

Six sage grouse strutting grounds and one sharptail grouse dancing ground lie in the general area of the proposed railroad. Access to three of these is maintained by county roads. County Road 30 lies adjacent to two sage grouse strutting grounds in Sections 26 and 35, T.5N., R.93W; Colorado Highway 13 provides visual access to a strutting ground in Section 21, T.6N., R.91W.

Scattered raptor nesting in Little Yampa Canyon and along Williams Fork River constitutes another dimension in wildlife viewing opportunities. See Chapter II, Terrestrial Fauna, for a more complete description of wildlife resources.

Significant recreational fishing opportunities occur in both the Yampa and Williams Fork Rivers; both lie in land units having a moderate capability to attract and sustain recreation use. The setting of the Yampa River (in the Canyon) is especially conducive to realizing its recreational capabilities. No public access is guaranteed on either river; however the Colorado DOW indicates that 50 percent of this portion of Yampa River is open to the public (see Regional Analysis, Chapter IV). Marginal fishing opportunities occur in Milk Creek (see Figure GRII-28). See Chapter II, Aquatic Fauna, for a more complete description of fisheries.

The BLM's Williams Fork land-use plan contains an analysis of the land's inherent capability to attract and accommodate recreation use. Figures GRII-27 and 28 display the relative capabilities inherent in various land units surrounding the proposed railroad route and two alternate routes. This rating pertains to existing recreation resources and does not imply management.

Refer to Chapter II, History and Archeology, for a more detailed evaluation of cultural resources in this area; the recreation capability classification referenced indicates their capacity to attract and sustain recreational use based on their human-interest values.

Other significant recreation resources values deserving mention on the Yampa River include its capabilities for floatboating (or canoeing), upland and waterfowl viewing, geologic interpretation, and rockhounding. In addition to its angling capabilities, Williams Fork River also attracts use due to its vegetative variety, pastoral landscapes, and upland, as well as waterfowl viewing capabilities (see Regional Analysis, Chapter IV).

Recreation Capability Classification

Legend for Figures GRII-27 and GRII-28

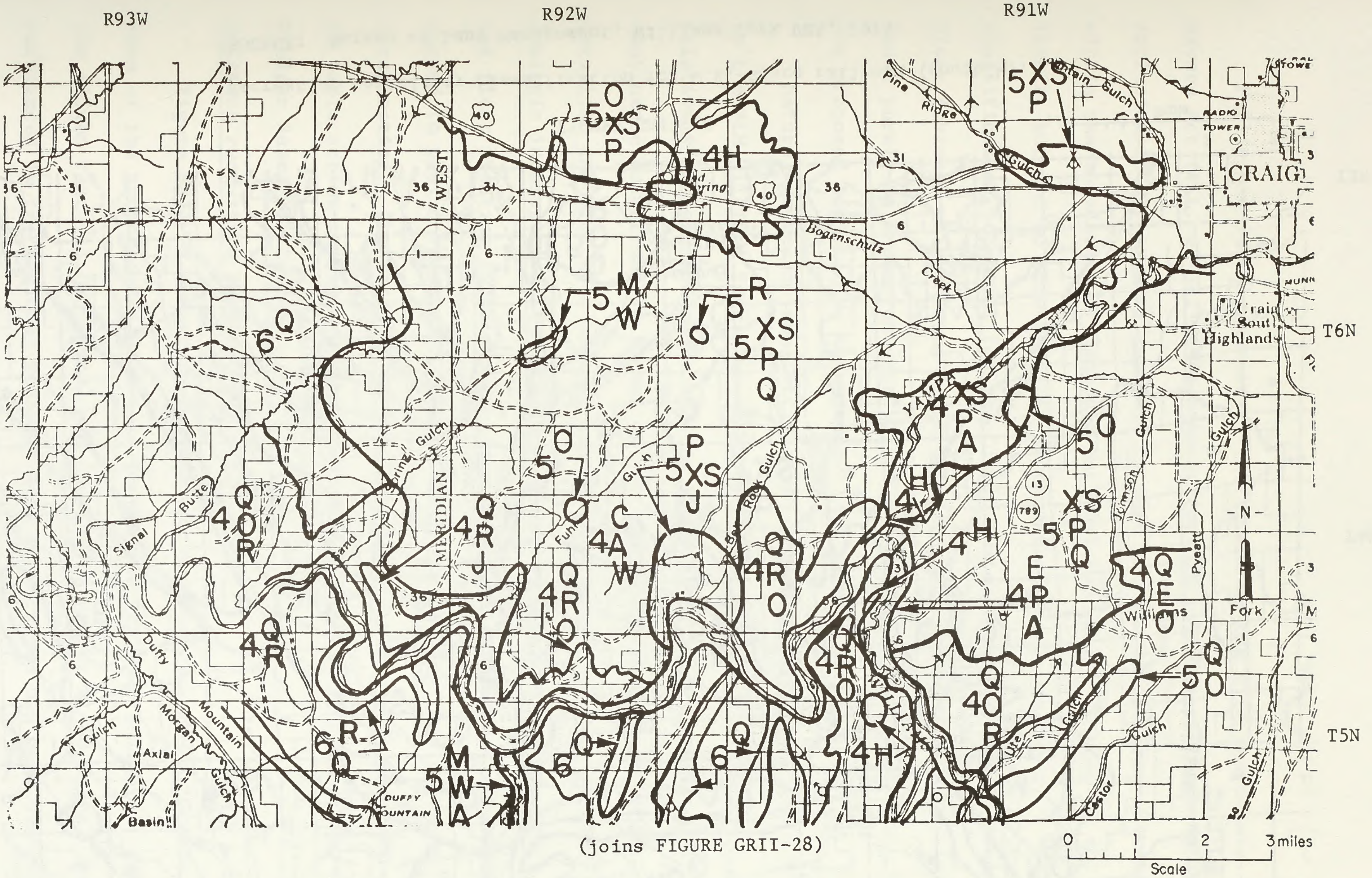
I. Capability Classes:

(Capability to attract and to accommodate recreation)

Class 1 - Very high; intensive activities
2 - High; intensive activities
3 - Moderately high; intensive activities
4 - Moderate; dispersed activities
5 - Moderately low; dispersed activities
6 - Low; dispersed activities
7 - Very low; dispersed activities

II. Sub-Classes:

(Recreation resources)
A - angling
E - interesting vegetation
H - cultural resources (historic and archaeologic)
J - rockhounding
K - organized camping
M - small water bodies
O - viewing upland wildlife
P - agricultural interest
Q - topographic - landscape variety
R - rock formations
V - panoramic view
W - waterfowl viewing
XS - snowmobiling



(joins FIGURE GRII-28)

FIGURE GRII-27

Recreation capability classification for W.R. Grace railroad (north ½).

SOURCE: Bureau of Land Management, Williams Fork URA, 1974

(joins FIGURE GRII-27)

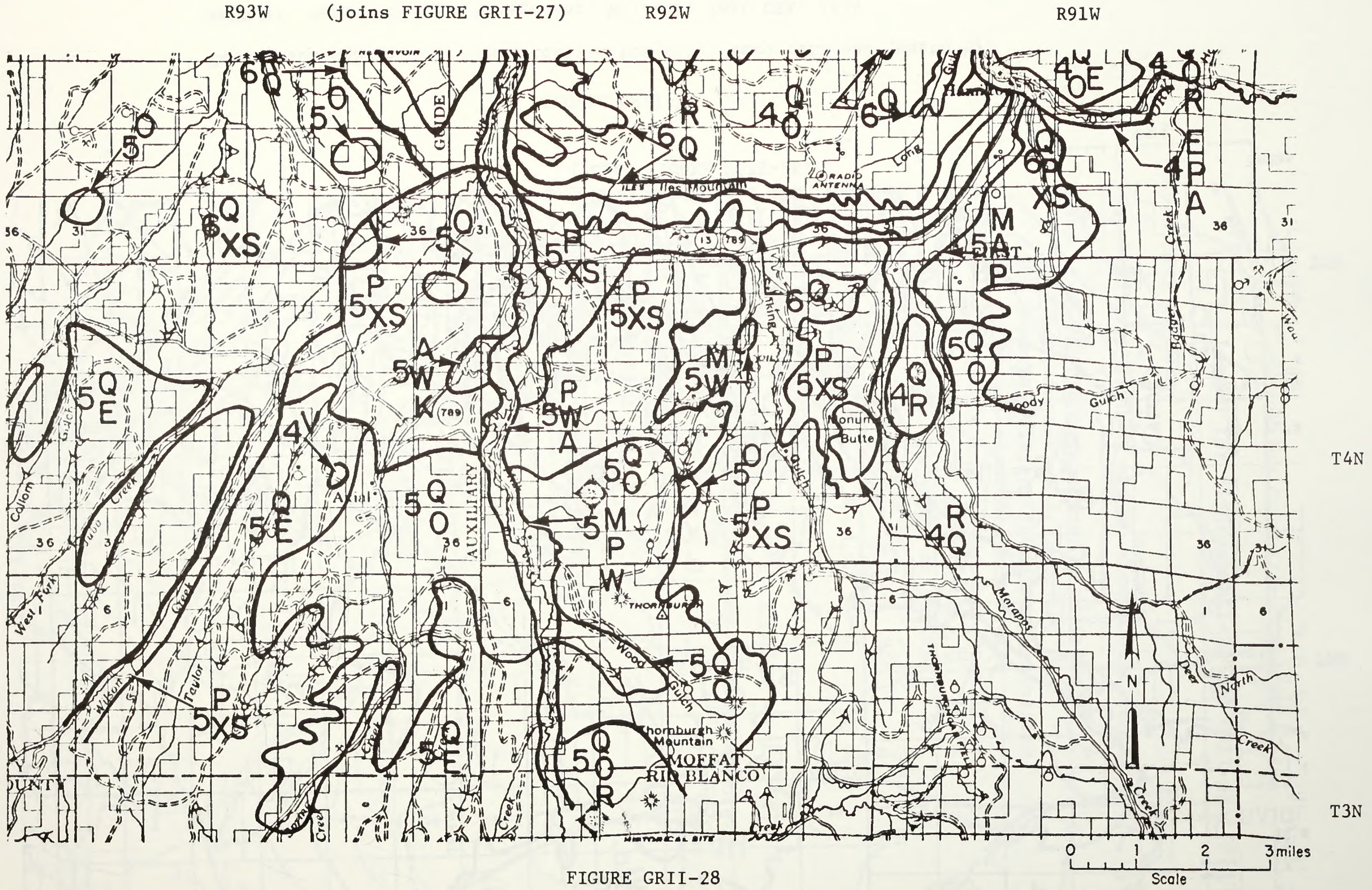


FIGURE GRII-28

Recreation capability classification for W.R. Grace railroad (south ½).

SOURCE: Bureau of Land Management, Williams Fork URA, 1974

Public Law 93-621, January 3, 1975, amends the Wild and Scenic Rivers Act (P.L. 90-542) to designate certain river segments for possible inclusion in the system; included is that portion of the Yampa River lying within the boundaries of Dinosaur National Monument. Related to the Act itself, but not to this specific amendment of it, is an inherent "Scenic" classification potential for the Little Yampa Canyon section of Yampa River (through which Routes A and B run). Note that this observation is based purely on known resource values and not on either feasibility studies nor proposed legislative enactments.

Natural values of the Little Yampa as canyon area have been recognized by the BLM Williams Fork Management Framework Plan (MFP) 1974. Due to the relatively undisturbed terrain along Yampa River from the Williams Fork confluence downstream to Signal Butte, the recommendation was made to establish the area as a natural area. Due to potential for rockhounding, geologic interpretive study, wildlife viewing (upland and waterfowl), and river floating capabilities, it was also recommended that the area be opened to public recreation by acquiring legal ingress and egress for floatboating. The decision in the BLM land-use plan (MFP Step III) was to table action on these recommendations pending the outcome of the proposed Juniper Reservoir Project.

Existing recreation developments

Figure GRII-29 shows two private big game hunting operations in the area of the proposed railroad (see Chapter IV Regional Analysis); they are the Ellgen ranch, 1,936 acres, and Camilletti ranch, 1,440 acres. Also referenced in the Regional Analysis is a 6,370 acres big game hunting area

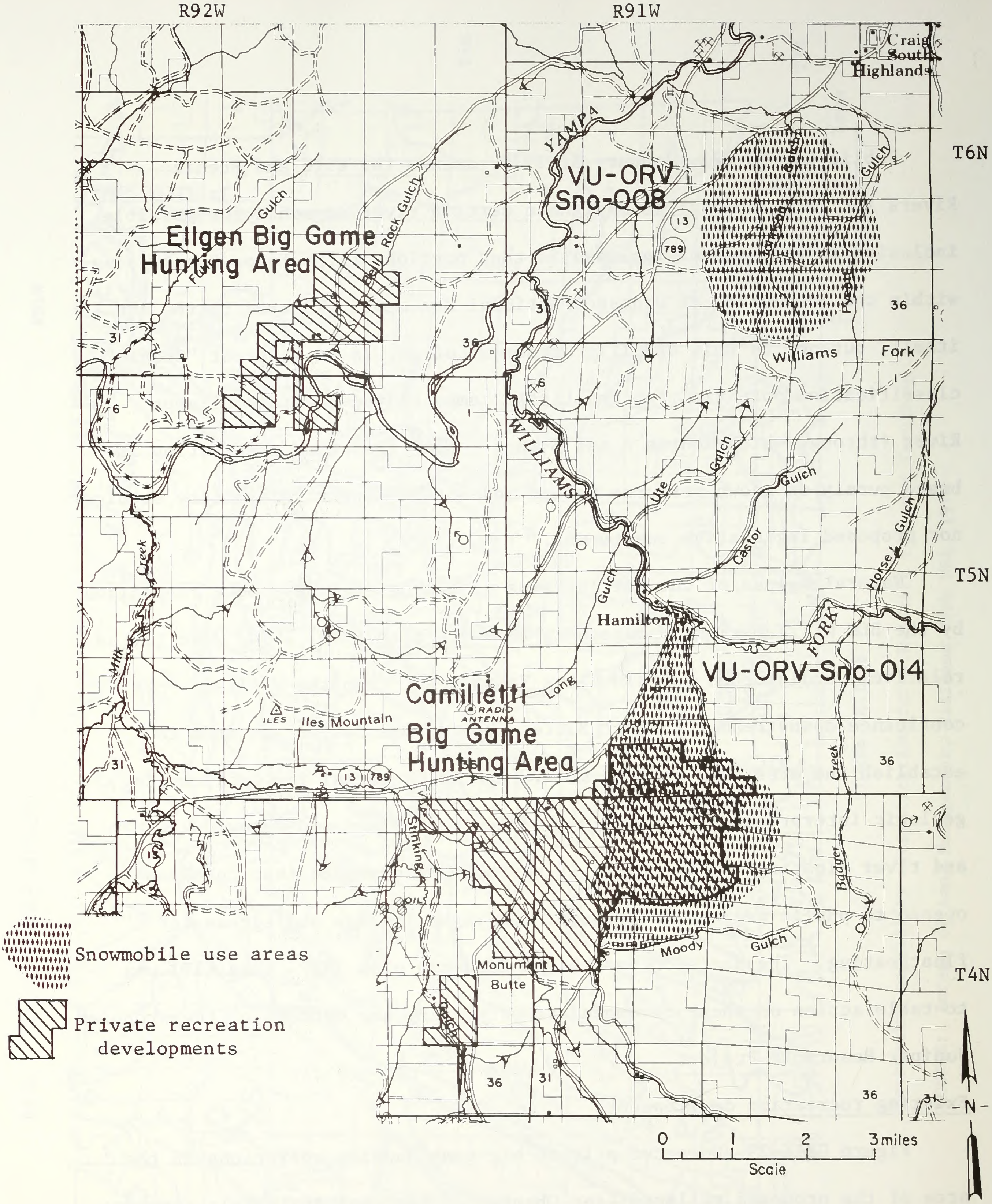


FIGURE GRII-29

Privately owned-and-operated developments and visitor-use at the proposed W.R. Grace railroad area.

SOURCE: Bureau of Land Management, Williams Fork URA, 1974
Soil Conservation Service, NACD Private Recreation Inventory, 1974

south of the Milk-Jubb Creek confluence (No. 19 under the Private Recreation section). However this operation has been purchased by W. R. Grace and Company and leased back for ranching and a determination has not been made at present as to whether or not hunting will be permitted in the future.

Recreation visitor-use data

Average Daily Traffic (ADT) volumes from the Colorado Division of Highways indicate traffic increases on all segments of U.S. 40 and Colorado 13 providing visual access to the three railroad routes (see Chapter II, Aesthetics). During 1974 traffic volumes on U.S. 40 (1,750) were greater than on Colorado 13 (730-1,500).

Origin-destination studies for Rifle and Steamboat Springs (Regional Analysis, Chapter IV) provide the nearest points for analyzing the composition of motorists. Forty-two percent of all traffic traveling Colorado 13 north of Rifle and 29.5 percent of all U.S. 40 traffic through Steamboat Springs were engaged in general recreation or vacation activities.

Figure GRII-29 also shows two snowmobile use areas in the vicinity of the proposed railroad. Area 008 south of Craig received both weekday and weekend use for an estimated 90-day season; total annual use was estimated at 1,260 visits. Area 014 south of Hamilton also experienced both weekday and weekend use; an estimated 90-day use season at this area yielded approximately 1,200 visits (BLM, Williams Fork URA, 1974). No additional visitor-use data are available.

Social Environment

The social environment that would be affected by W.R. Grace and Company's proposed railroad extends from the immediate, sparsely populated area of the Axial Basin north and east to Craig and Hayden and south to Meeker. The Axial Basin is a ranching area with fewer than 10 ranch houses while the community of Axial has only three residences.

Of the three other communities, Craig is the largest with a current population of about 6,000. Both Craig and Hayden, with a current population of about 1,700, are now experiencing boom town conditions, due to the construction of Colorado Ute Electric Association's power plant and Utah International's surface coal mine. The housing market is tight, the crime rate is increasing sharply, and new demands are being placed on already over-utilized social support facilities (e.g., water and sewer treatment, schools, etc.). This condition will probably continue over the next three years, until the power plant construction is complete.

Meeker with a current population of about 1,800 is also encountering some growth problems as a result of preliminary development of oil shale resources in the Piceance Basin. Housing shortages, increased crime, and increased demands for social support facilities will continue in the future as oil shale development reaches commercial stages.

For a more extensive analysis of the social environment, refer to Chapter IV of the Regional Analysis.

Economic Conditions

In areas that will be affected by the development of W. R. Grace and Company's railroad, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future it is expected that the mineral-extracting sectors will gain in importance as the development of non-coal related energy resources proceeds.

Currently, the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six per cent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector, which traditionally is a high income industry.

For a more extensive analysis of the economic conditions, refer to Chapter IV of the Regional Analysis.

Transportation Networks

Railroad

There are no existing rail lines into the area of the W. R. Grace mine site. The closest existing rail facility is a planned D&RGW Railroad spur running southwest of Craig to the Colorado Ute plant site; contracts have been let for this planned construction. This spur will connect with the existing D&RGW branch line running east from Craig.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER IDENTIFIES AND ANALYZES THE IMPACTS THAT WOULD OCCUR TO THE EXISTING ENVIRONMENT IF AND WHEN A RAILROAD IS CONSTRUCTED. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE.

CHAPTER III

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

Non-living Components

Geologic and Geographic Setting

Topography

The proposed railroad route would impact the topography by adding cuts and fills where none exist. Part of these fills would encroach on the Yampa River. Riprap needed for these and similar fills, derived from local materials, is estimated by Morrison-Knudsen (Feasibility Study, October 1974) to be 21,400 cubic yards.

Two areas along the proposed route would require 70-foot cuts with the median cut on the entire route being less than 20 feet. Maximum fill would be about 90 feet at one location and the median fill on the entire route would be about 15 feet.

Stratigraphy and structure

The only impacts the railroad would have on stratigraphy and structure of the area would be beneficial, in that the numerous cuts would furnish good exposures for study.

Paleontology

Impacts to fossils would occur as they are removed in construction of the railroad. It is very likely, given the large amount of acreage to be disturbed (440 acres) that at least some invertebrate fossil destruction would occur; proposed Route A traverses four fossiliferous formations: Mancos shale, Iles Formation, Williams Fork Formation, and the Lewis shale.

Geologic hazards

Certain parts of the routes would be potentially hazardous to the construction and/or maintenance of the railroads. The company's environmental report makes this statement:

> Geologic hazards considered significant to the project are seismic shaking, surface faulting, slope stability, foundation stability, and flooding.

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Most obvious potential hazards would be rockfalls, mudflows, landslides, and slumps along the steep canyon sides. Evidence of instability in the Williams Fork Formation is present in the form of an existing landslide deposit along the proposed route, from 1.7 to 2.0 miles downstream from the mouth of the Williams Fork River. Flooding streams could undercut the roadbed. Flash-floods in smaller streams could cause maintenance problems to the railroad, such as Ralston Draw, which drains part of Iles Mountain and crosses the proposed railroad before joining the Yampa River.

A potential hazard to the completed and operating railroad would be possibility of earthquakes, which could cause failure of the railroad's sub-base, as well as cause landslides and rockfalls. This possibility is considered to be rather remote, as indicated in the environmental report written for the company:

> The region is a relatively quiet seismic area and is within a zone of minor seismic risk. Five earthquakes of Maximum Modified Mercalli (MM) Intensity V (estimated) have occurred within 100 miles of the site.

However, a possible source of additional earthquake activity might be present in a few years. The proposed Juniper Dam and Reservoir of the U.S. Bureau of Reclamation would be in a faulted area. Reservoirs in faulted terrain are possible triggers for earthquakes. The company's environmental report takes note of the hazard of placing the roadbed on deep alluvium:

> Foundation instability in deep alluvium may be a hazard, especially under high fills. Saturated alluvium subject to vibrations or cyclic stress from loaded trains may cause liquifaction. Marshy, low, alluvial deposits may have to be over excavated and recompacted.

Earthquakes would increase the hazard of vibrations affecting saturated alluvium in fills.

Mineral Resources

Coal

Impacts of the proposed railroad route on coal resources of the region may be divided into beneficial and adverse impacts.

There would be a beneficial impact in that the availability of the coal in the region would be increased by the presence of a railroad; this is particularly true for the coal beds of the Danforth Hills region.

The adverse impact would be the blocking of coal development along the route itself. For example, the following statement is made in the report by C. W. Wade, geologist (International Engineering Company), in the Appendix of Morrison-Knudsen's Feasibility Study:

> In the SE 1/4, NE 1/4, Section 36, T.6N., R.92W., (near MP A-5.2) the proposed route appears to pass through an area where bulldozer cuts have been made to expose coal beds. Future mining activity is apparently planned.

Gravel

Ballast for the railroad roadbed is described by Morrison-Knudsen's Feasibility Study of October, 1974 as follows:

> Ballast material estimates are based on American Railway Engineering Association size. G-3 crushed gravel graded from 1 1/2" down to 1/8" with 41-75 percent crushed particles. This ballast can be provided from a pit located south of Craig.
>
> Ballast depth is 20" and extends 8" beyond ties except on the outside of curves greater than 2° where it will extend 12" beyond the ties. The unusual depth of the ballast precludes the need of subballast except in special cases.

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The pit mentioned is presumably in SW 1/4 Section 7, T.6N., R.90W., which is in terrace gravels along the edge of the Yampa River valley. Use of this gravel would reduce the region's gravel resources by a small amount. Using data in the railroad feasibility study the approximate amount of gravel to be used is 92,900 cubic yards.

Water Resources

Ground water

The proposed railroad would impact availability of ground water in the area if any existing wells fall within the right-of-way.

The railroad would have minor local effects on recharge and discharge of ground water. Filled areas along the railroad would reduce normal infiltration of snowmelt and spring rains but this would be partly compensated by increased infiltration along the sides of fills. Where fills cover areas of water-loving vegetation, the discharge would be reduced and shifted to adjacent areas. The net effect on ground water would be negligible.

Some proposed cuts would intercept the water table; they would create new points of ground water discharge. The amount of water discharged from any one of these cuts would not likely exceed a few gallons per minute, which would have no significant impact on ground water in the area.

The most important and only significant impact related to ground water would be slope instability in cuts that intercept the water table. When the water table is interrupted a new point of ground water discharge is created with local upward flow of ground water. This upward flow reduces the cohesiveness of the material through which the water is moving. Cuts in the Lewis Shale would be the most likely to cause problems because the rock has a history of instability.

Surface water

Increase in sediment yield due to the construction of the railroad would be from two principal sources: (1) cuts and fills required by construction, and (2) channelization of the streams where the railroad encroaches on them.

Sediment yield as the result of cuts and fills would depend on the erodability of the material and the transport efficiency from the source to the stream. Along 82 percent of the right-of-way the railroad would not infringe directly on the stream, so runoff from cuts and fills would flow over land before entering the stream; most of this sediment would be deposited before it reaches the stream. In these areas the sediment yield would be about two acre feet/square mile, which is 1.5 acre feet/square mile more than normal for the area. Where the fills infringed on the stream, runoff from the fill material could go directly into the stream with no chance for disposition along the way. In these areas the sediment yield would be about three times the increase for sediment yield for the remainder of the railroad, or 4.5 acre feet/square mile. The amount of sediment expected from cuts and fills during the first year following construction would be about 1,300 tons for the part that does not infringe on the river, and 900 tons for the part that does infringe on the river, for a total of 2,200 tons.

The channelization of Milk Creek and the Yampa River would expose fine materials to stream erosion. Assuming 4.3 acres of disturbed area for such channelization, and assuming 0.2 feet of erosion from these channel bottoms during the first year following construction, there would be about 1,900 tons of sediment produced from this source. The total first-year sediment yield would therefore be about 4,000 tons. The "first year" sediment yield would, however, be spread out over the two year period of construction; the amount produced during each of the years would depend upon the exact construction schedule.

This discussion covers only the sediment that would result from erosion. There would be some sediment produced by local filling and direct excavations in the stream. No estimate has been made of the amount of this sediment; however this subject will be addressed further in the chapter on mitigating measures.

Contamination resulting from spillage of diesel fuel or coal in a train accident could be detrimental to water quality. The likelihood of such occurrences can be approximated from recent statistics concerning accident rates on other modern railroads. According to Federal Railroad Administration Bulletin 142, the probability of train accidents during the period 1969 through 1973 averaged 2.7 per million train miles on the modern and well-equipped Florida East Coast Railway. Since the proposed coal haul railroad would be constructed and maintained to the highest available standards and is less than 25 miles in total length, accident probabilities would not be expected to reach even the 2.7 per million miles level. However, by applying that figure to the miles of proposed railroad adjacent to a stream where spillage might contaminate surface waters, the maximum percentage probability of an accident is 1/10 of one percent over the 30-year life of the project. Therefore, water quality deterioration from train accidents would not be a matter of concern.

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Air Quality

The impact of the railroad on air quality can be divided into two phases: (1) the construction phase, and (2) the operational phase.

The construction phase would involve extensive earth moving, hauling, grading and blasting, as well as bridge construction. Construction is planned for two successive seasons, from April to November for two years beginning in 1976. As the building proceeds, intermittent fugitive dust emissions would be expected locally along the railroad bed and the haulage roads. Dust emissions would be expected to exceed the 24-hour standards for suspended particulates within 100 meters (300 feet) of area of maximum activity; these emissions could be mitigated to some extent by watering. Vehicle emissions of NO_x, HC, and particulates during construction would have a minimal impact on air quality even locally around the zone of maximum activity.

During the operational phase, freight trains would be run periodically, with operations primarily in daylight hours. The proposed operations schedule has been reported by W. R. Grace (1975). The average emission factors assuming diesel engine usage and expected annual emissions are listed in Table GRIII-1 for proposed Route A and alternate Routes B and C. These railroad emissions represent a minimal impact on local air quality for the regulated pollutants.

TABLE GRIII-I

Annual Diesel Emissions from the Proposed W. R. Grace Railroad

Pollutant	Average Emissions Factors[1] (kg/10^3 liter)	Emissions[2] (metric tons/year) Route A	Route B	Route C
Particulates	3	.52	.51	.61
Sulfur oxides (SO_x as SO_2)	6.8	1.18	1.15	1.37
Carbon Monoxide	16	2.78	2.72	3.23
Hydrocarbons	11	1.91	1.87	2.22
Nitrogen Oxides (NO_x as NO_2)	44	7.65	7.47	8.89

[1] From EPA (1972)

[2] Computed assuming .10 km/liter fuel use

Living Components

Soils

Impact on soils would result from disturbance of 440 acres by construction of the proposed railroad. About 70 acres would be removed from productivity by a cover of ballast, track, bridges, etc. Acreage permanently disturbed because of steepness, rockiness, riprap, and areas provided for snow removal would be approximately 300 acres.

Impacts would be caused by the following activities: (1) blasting and moving 1,521,700 cubic yards of soil material, (2) compacting of topsoil and lower horizons by heavy equipment, (3) removing vegetation which would increase erosion, (4) exposing fine grained soil and parent material during construction of access roads and camps, (5) mining and removing material for use as ballast, and (6) developing and removing soil from barrow pits along the right-of-way. The majority of these impacts would occur during two normal construction seasons of seven months, beginning in mid-April and ending in mid-November. Removal from productivity and exposure of soil to wind and water erosion on unvegetated steep cut slopes would be permanent impacts. Soil properties and characteristics which would be impacted are: resistance to erosion, sediment yield, soil moisture relationships, infiltration rates, available water holding capacity, permeability, bulk density, bearing capacity, soil structure, soil texture, and chemical composition.

Table GRIII-2 lists acreages to be disturbed and lost to productivity by soil associations. Descriptions of these soil associations are in Appendix D.

TABLE GRIII-2

Acreage of Soil Associations Disturbed and Removed from Productivity
by Railroad Construction Within the Right-of-Way

Association	Acres Disturbed	Acres Permanently Removed
21	97	81
35	282	237
41	61	52
	440	370

Surface disturbance which destroys topsoil characteristics would reduce permeability and increase runoff, adding to existing sediment load of drainages crossed by the right-of-way. Productivity levels would be lowered until the soil has had time to reestablish its structural and micro-organism relationships.

Handling and disturbing the soil material in cuts and fills would completely disrupt and destroy the present soil horizon relationships which have been established over a long geologic time span. The end result of this action would result in soils with characteristics that are a conglomerate of existing soils and very dissimilar.

Compaction would have a major impact on surface soils along the railroad right-of-way and its areas used for access during construction. Compaction would decrease infiltration rates, permeability, and available water-holding capacity for many years after construction, and thus would reduce reclamation potential of the disturbed areas.

Offsite impacts on soils would include those caused by excavation of ballast material, development of disposal areas for liquid and solid wastes, construction of ponds to provide water and control surface runoff and construction of camps, storage areas, roads, and power lines.

Terrestrial Flora

Construction of the railroad would result in disturbance of approximately 440 acres of vegetation, of which at least 70 acres would be permanently covered by the railroad bed, and approximately 300 acres not revegetated because of steepness, rockiness, and areas provided for snow removal. Table GRIII-3 gives approximate acreage disturbance by vegetative type for the proposed Route A, alternate Routes B and C, the proposed Taylor Creek terminal, and the alternate Jubb Creek trail and Jubb Creek loop terminals. The acreages presented are calculated on an aerial basis; therefore the actual surface area of disturbance, and thus the area to be reclaimed, would be larger in areas of variable topography.

TABLE GRIII-3

Vegetation Types and Amount Disturbed by Each Route and Terminal Alternate (Acres)

	Vegetative Type					
	Sage-Brush	Mtn. Shrub	Pinyon-Juniper	Cropland	Riparian	Total
Route A	119	67	3	62	115	366
Route B	169	10	6	76	94	355
Route C	176	18	16	59	154	423
Taylor Creek Tail Track	28	-	16	30	-	74
Jubb Creek Tail Track	16	-	4	47	-	38
Jubb Creek Loop Track	13	-	-	25	-	38

If deep cuts would be constructed through areas of Lewis or Mancos shale, some side slopes might need to be as low as ten percent for stability; this would greatly increase the area of disturbance. Steep areas along the Yampa River and Milk Creek would require large steep cuts that would make revegetation difficult or impossible because of the steepness and sparse soil material. Cuts through areas of rock would be relatively free from erosion, but would be permanently void of vegetation.

Areas of sagebrush, cropland, and riparian vegetation would be the easiest to revegetate because they are relatively flat, and sufficient soil would be available to provide a suitable seedbed for plant growth. Areas that are steep or are on Lewis or Mancos shale would be difficult to revegetate. Disturbed areas of riparian vegetation might not be difficult to revegetate, but would be very difficult to return to existing vegetation. Mountain shrub and pinyon-juniper areas along the proposed railroad would be very difficult to revegetate because of the steep, rugged, rocky terrain in which they occur.

Undetermined additional impacts on vegetation would result from borrow areas for fill, and construction and maintenance access routes. These areas of borrow and need for access have not been identified in the proposed action, and therefore impacts are not quantified.

Disturbance of the surface by heavy equipment would create hard flat surfaces that are not conducive to plant establishment. Many areas of exposed subsurface material probably would be lacking in plant nutrients, thereby decreasing revegetation success.

The length of impact of vegetation loss would depend on the success of reclamation. Since the reclamation plan includes seeding of only a few of the species native to the disturbed areas, loss of native vegetation would be quite long, depending upon the rate and ability of native species to invade the areas. In areas that cannot be revegetated due to rockiness,

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toxicity, steepness, soil texture, etc., loss of vegetation would be a permanent impact. In some years climatic conditions might cause revegetation attempts to fail, extending the impacts of vegetative loss.

A secondary impact due to the destruction of vegetation would be the invasion of weedy species. Weedy species such as summer cypress (Kochia scoparia) would compete with revegetation attempts, thereby decreasing the success of permanent vegetative establishment.

Another impact to vegetation during railroad construction and the coal loading process would be fugitive dust and coal dust. Although it is difficult to predict the degree of impacts, those from fugitive dust probably would be minor and those from coal dust would depend on the cleanliness of the loadout facility. Dust-covered plants might exhibit a decrease in vigor due to slower photosynthetic rate. Dust-covered vegetation might be less palatable and possibly toxic to livestock and wildlife; however this would likely constitute a very minor impact.

Young, palatable vegetation produced by revegetation efforts would attract wildlife and livestock; grazing on young plants would inhibit early growth and revegetation of disturbed areas.

Terrestrial Fauna

Wild fauna

Construction of the proposed railroad would impact the area's wildlife in several ways. Major impacts on terrestrial fauna would result from two separate sets of factors: railroad construction and railroad operation.

Railroad construction

The segment of the proposed route from Craig to the Williams Fork River would transect cropland and riparian vegetation types, and could impact nesting and courtship activities of the greater sandhill cranes that are known to nest in Big Bottom. Approximately seven pairs of sandhills use this area (Figure GRII-6). Although the proposed route would not disturb the nesting area directly, noise and human activity caused by the construction work, blasting, etc., could disturb the cranes' activities and result in a failure to nest, or nest abandonment.

At least one sage grouse strutting ground has been identified in this area and there may be more that have not yet been located. As proposed, this segment of the railroad would be constructed directly through this critical courtship area resulting in a loss of its use by these gamebirds.

Sagebrush and mountain shrub, which cover about 214 acres of land that would be disturbed, provide habitat for over 130 species of wildlife including deer, elk, antelope, sage grouse, and a variety of non-game species (see Appendix D). Destruction of this vegetation would reduce the carrying capacity of the area for those associated species. Deer, elk, and sage grouse would be directly affected. Hawks, coyotes, eagles, and owls would be indirectly affected because of the loss of prey habitat resulting in the eventual loss of prey species.

According to Colorado DOW density estimates, the proposed route would result in the permanent destruction of habitat capable of supporting about five elk, five deer yearlong, and an additional ten deer during the winter months. These losses are related to an estimated disturbance of 440 acres of big game habitat.

In addition to sagebrush and mountain shrub loss, 115 acres of riparian habitat would be destroyed. Riparian vegetation is generally considered to be the most important habitat for sustaining wildlife numbers and species diversity. Further disturbance of riparian vegetation would be expected from railroad fill material being dumped down slopes and into the Yampa River, covering the riverside vegetation. The amount or exact location of this habitat loss is not known.

Ducks and geese are known to nest along the Yampa River. This nesting activity would be disrupted during railroad construction and some nest locations would be destroyed. An estimated five goose nests and as many as 30 duck nests could be lost. Nest and den sites for non-game birds and mammals also would be destroyed.

The remainder of this segment of the proposed route would transect 62 acres of cropland and 3 acres of pinyon-juniper. Pinyon-juniper type provides cover and some browse for big game mammals; however, wildlife species diversity is generally low in this type of habitat. Cropland represents previously disturbed lands that are kept in a constant state of disruption. These areas are monocultures and as such generally provide the poorest habitat in terms of species diversity. Because the land already is disturbed, the impacts on wildlife generally would be minimal in these areas.

Normal animal movements and activities would be disrupted during the construction phase of this operation. The extent and duration of this

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disruption would depend on the species involved, the time of year the construction work is conducted, and the length of time it takes to complete the railroad.

The Yampa River provides both summer and winter use areas for hawks, eagles, and other raptors. Nest and perch sites could be destroyed or altered to make them unsuitable for use by these birds. The loss of prey habitat would reduce the area's carrying capacity for predatory birds. Human activity and noise associated with railroad construction would cause some reduction in the utilization of the area by birds of prey.

The Milk Creek segment of the proposed railroad would cross and recross the creek several times. Almost the entire length of this segment would be in riparian habitat; however, it is not as lush as that found along the Williams Fork or Yampa Rivers. Therefore, impacts associated with disturbance of riparian vegetation would be considerably less along Milk Creek.

This segment of the proposed route does cross a deer and elk migration route and the railroad construction would alter the normal migration patterns for these animals.

Impacts on nesting waterfowl or raptors would not be expected to be significant along this segment of the proposed route.

The segment of the proposed railroad line that starts at the head of Milk Creek Canyon and runs south across Axial Basin to the proposed terminal area would cross sagebrush and cropland. Railroad construction along this segment could impact both sage grouse strutting activities and pronghorn antelope movements. Three sage grouse strutting grounds have been identified here, and if railroad construction takes place in close proximity during the period of mating activity, the breeding potential for a major portion of Axial Basin sage grouse population could be affected.

Pronghorn antelope that inhabit this area would be impacted by the restriction of their movements during railroad construction. Loss of food and cover capable of supporting one or two pronghorns probably would result.

Some direct loss of wildlife would result from the construction of any segment of the proposed railroad. Small or less mobile animals would be unable to escape the construction equipment. Blasting would kill many animals and destroy dens and nests; bulldozers and scrapers also would cause some deaths.

Small mammal densities and species diversity normally are greatest in areas of riparian vegetation; therefore segments of the route creating most disturbance in these areas would probably cause the greatest loss of life to small mammals. Greater bird nesting densities are also found in this habitat type.

The railroad right-of-way would be fenced; impacts on terrestrial fauna would depend on fence specifications and species present. Fences impede or prevent normal movements of large to medium sized mammals; they also create potential hazards to birds and mammals that may become entrapped in them. Fences along a railroad right-of-way may also tend to restrict escape inside the right-of-way when animals become alarmed at the approach of a train.

The Taylor Creek terminal area would involve habitat destruction primarily in sagebrush and cropland (see Figure GRI-1). Impacts on terrestrial fauna would be similar to those discussed for segments passing through these vegetation types.

Beaver workings have been found along Taylor Creek. The construction work would disturb this species and possibly cause their abandonment of the area.

Some habitat in the right-of-way would be permanently removed from its present productivity, but revegetated areas would provide new habitat. Revegetated areas commonly attract greater numbers of wildlife than the adjacent undisturbed native vegetation for the first few years because of the succulent nature of new growth. If this is the case along the proposed railroad, wildlife would be drawn to these areas and the probability of train-animal collisions would be increased.

Railroad operation

All habitat destruction would be complete before this phase of the plan begins. No new habitat destruction would be expected, although some brush and weed control might be conducted along the railroad right-of-way on previously disturbed areas. The major impacts of the operation of this railroad on terrestrial fauna would be harassment and train-animal collisions.

The harassment factor of the railroad would be mainly the noise associated with passing trains; most wildlife species would become accustomed to this noise. Some species, however, such as sage grouse and sandhill cranes, might not be able to adjust to disturbance during critical nesting and courtship periods, and abandonment of strutting or dancing grounds, as well as traditional nesting areas, could result.

Train-animal collisions would occur during operation of the railroad. Major deer and elk migration routes cross the proposed rail-line, and pronghorn antelope are found along some segments of the route, mainly in Axial Basin. In addition to the big game species, many small mammals such as rabbits, hares, ground squirrels, and skunks would likely be lost because of train-animal collisions.

Domestic fauna

Livestock would probably not be destroyed as a direct result of the railroad construction. The domestic animals would be moved away from the area during blasting and earth moving.

The main impacts on domestic fauna would be loss of food and restriction of movement resulting from new fencing. If the railroad line is not fenced livestock would be lost to train-animal collisions.

Some loss of forage would result from construction of the proposed railroad. Table GRIII-4 indicates the estimated losses of carrying capacity in terms of domestic animal AUMs (Animal Unit Months). No replacement of lost AUMs would be expected in the future because of the proposed fencing of the railroad right-of-way.

TABLE GRIII-4

Loss of Carrying Capacity by the Proposed Railroad

Vegetation Type	Acres Disturbed	Carrying Capacity (Acres per AUM)	Loss of AUMs
Mountain shrub	67	5.5	12
Sagebrush	147	7.0	21
Pinyon-juniper	19	27.5	1
Cropland	92	7.0	13
Riparian	115	3.5	33
Total	440		80

Aquatic Biology

Construction of the proposed railroad would involve extensive alteration of the natural channel of Milk Creek, thereby creating an increase in stream sedimentation during construction activity and continuing until the disturbed surfaces are revegetated. Increased siltation in Milk Creek would increase the sediment load carried by the Yampa River in the area of the proposed action. Rock cuts required in steep slopes above the Yampa River, and encroachments of fill material into the river's main stream, would be the principal sources of increased sedimentation. The degree of increase depends on construction methods and erosion control measures implemented during and following construction. Construction of two bridges across Williams Fork River and Milk Creek also would increase sedimentation in Yampa River.

Construction of the railroad would impact the biological community of Milk Creek. Stream channelization would eliminate organisms through localized destruction of the existing stream habitat. Benthic organisms and periphyton would be particularly impacted due to their relative immobility; members of the existing fish population might be able to migrate into the Yampa River.

Any increase in sedimentation in the Yampa River would impact the aquatic community through the silting-in of critical feeding and spawning areas and direct abrasion and suffocation of organisms. Spawning populations of the four endangered fish species known to inhabit the Yampa River between Craig and the confluence with the Green River are of particular concern. Degradation of the existing water quality of the Yampa River in the area of proposed construction could constitute a violation of Sections 4 or 9 of the Endangered Species Act of 1973 (Public Law 93-205, 93rd Congress, S. 1983, December 28, 1973).

The existing and potential endangered fisheries habitat in Yampa River in the proposed railroad construction area would be an important consideration. If it would be necessary to adversely impact this segment of the Yampa, impacts must be mitigated whenever possible. The construction of the proposed rail line would significantly increase, at least temporarily, the sediment load carried by the Yampa River. The sediment load increase in Yampa River resulting from construction would be temporary. As is the case with most endangered species, any adverse environmental impacts could readily change marginal habitat conditions into intolerable habitat conditions for the species.

The native species in the large rivers of this region have evolved in the presence of high turbidity and salinity. Increased sediment during high-flow periods probably would have minor impact on large river species, but increased sediment during periods of low and clear flow could constitute an impact of considerable consequences. The time of year and duration of increased sediment are important factors, because if this impact occurred during spawning it could affect the success of the spawn. Some fisheries scientists believe that increased turbidity during spawning may be beneficial because of increased cover and protection for eggs and emerging fry. Until more information is available, however, and habitat needs and limitations are clearly understood, the impact of increased sediment during spawnings should be considered adverse.

Regional energy development and associated industries could result in transportation of products other than coal over this line. A derailment into the Yampa could result in an impact on aquatic fauna depending on the product, quantity of spill, and time of year. The impact on the squawfish population could be devastating if a toxic spill occurred during spawning when the majority of the population is congregated in the Yampa during low flow.

Cultural Components

Archeological Resources

Total projected acreage disturbance on the railroad is 440 acres to occur during 1977 and '78; destruction of archeological resources would be commensurate with this acreage disturbance. Impacts would also result from increased exposure of archeological values. The projected railroad construction force is 110 for both 1977 and 1978. In addition, a 29-man operation crew is projected through 1990.

Table GRIII-5 shows the probable impacts that would result to cultural resources. Site numbers refer to the sites depicted on Figure GRII-9. All sites would be exposed to vandalism and pothunting. Subject to complete physical displacement are 25 lithic sites, three chipping sites, and three campsites. Subject to partial displacement are five lithic sites and one rockshelter. Two sites, potentially eligible to the National Register would be subject to adverse impact from post survey excavation, should the surveying archeologist's recommendations be followed (sites numbered 14 and 78, Table GRIII-5).

Unknown subsurface archeological sites could also be impacted due to the projected 440 acres of surface disturbance.

Historical Resources

Impacts to historical features due to acreage disturbance and due to potential vandalism from construction crews would be the same as identified under Archeological Resources above.

Table GRIII-5 also indicates probable impacts to historical resources; site numbers also refer to the sites depicted on Figure GRII-9. Subject to complete physical displacement would be three sites containing historic buildings and one site containing foundation-like rock structures.

TABLE GRIII-5

Impacts to Cultural Resources

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							Probable Impact		
				Archeologic					Historic		Subject to Direct Physical Displacement		Subject to Vandalism
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Structure	Complete	Partial	
1	x	x	x							1			x
2	x	x	x						11		x		x
3	x	x	x	x									x
4	x	x	x						2				x
5	x	x	x	x									x
6	x	x	x	x								x	x
7	x	x	x	x							x		x
8	x	x	x	x								x	x
9	x	x	x	x									x
10	x	x	x	x									x
11	x	x	x	x									x
12	x	x	x						3		x		x
13	x	x	x	x							x		x
14	x	x			x			x					x
15	x	x		x							x		x
16	x	x		x								x	x
17	x	x		x							x		x
18	x	x			x							x	x
19		x							3		x		x
20		x		x							x		x
21		x		x							x		x
22		x		x							x		x
23	x			x							x		x
24	x						x				x		x
25	x					x					x		x
26	x					x					x		x
27	x					x					x		x
28	x			x							x		x
29	x									1	x		x
30	x			x							x		x
31	x			x									x
32	x				x							x	x
33	x			x							x		x

TABLE GRIII-5 (Cont'd)

Impacts to Cultural Resources

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							Probable Impact		
				Archeologic					Historic		Subject to Direct Physical Displacement		Subject to Vandalism
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Structure	Complete	Partial	
34	x			x							x		x
35	x			x							x		x
36	x			x							x		x
37			x					x				x	x
38	x			x							x		x
39			x					x				x	x
40	x			x							x		x
41	x			x								x	x
42	x		x	x							x		x
43	x		x	x									x
44	x		x				x				x		x
45	x		x						1		x		x
46	x		x	x							x		x
47	x		x	x							x		x
48	x		x	x								x	x
49	x		x	x							x		x
50	x		x	x							x		x
51	x		x	x							x		x
52	x		x	x							x		x
53	x		x				x						x
54	x		x	x							x		x
55	x		x	x							x		x
56	x		x	x							x		x
57	x	x	x	x							x		x
58	x	x	x	x							x		x
59			x						4		x		x
60	x		x	x									

TABLE GRIII-5 (Cont'd)

Impacts to Cultural Resources

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							Probable Impact		
				Archeologic					Historic		Subject to Direct Physical Displacement		Subject to Vandalism
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Structure	Complete	Partial	
61			x	x							x		x
62			x			x					x		x
63			x	x									x
64			x	x							x		x
65			x	x							x		x
66			x			x					x		x
67			x						4		x		x
68			x	x							x		x
69			x			x					x		x
70			x			x					x		x
71			x	x							x		x
72			x			x						x	x
73			x	x							x		x
74			x	x							x		x
75			x	x							x		x
76			x	x									x
77			x	x									x
78			x				x						x
79			x	x									x
80			x	x									x
81			x	x									x
82			x	x									x
83			x	x								x	x
84							x						x
85				x									x
86				x									x
87				x			x						x
88								x					x
89								x					x

Aesthetics

The areas to receive the greatest impacts would be those where proposed actions do not borrow form, line, color, and texture (visual dominance elements) from the characteristic landscape. In other words, when the dominance elements inherent in the proposal do not complement those of the landscape into which the proposal is to be placed, it will not "fit" and is therefore labeled a minus deviation.

Landscape visual units with greater visual exposure to the viewer have the greatest impact on the highway user. By referring to the landscape visibility maps (Chapter II) and the proposed action areas (Chapter I), landscape units with the greatest visual exposure can be identified.

In terms of distance, the most sensitive areas are foreground visual units, and the least sensitive are background units. This can be read directly from the landscape visibility maps.

When the landscape visual units are viewed rather obliquely, their portion of the total picture plane is relatively small. When viewed more directly (at a greater viewing angle) the picture plane size increases in scale and so do the minus deviations that occur there. This also can be read from the landscape visibility maps by referring to: (1) contour alinement (for aspect), and (2) contour spacing (for slope), both with respect to the viewshed sequence that provides visual access to the particular landscape visibility unit in question.

A greater potential for adverse impacts also occurs when landscape visual units: (1) may be viewed from more than one viewshed sequence (road segment), (2) are viewed for a greater distance along those viewshed sequences and (3) lie at different distances when visible from more than one viewshed sequence. This can also be read directly from the landscape visibility maps.

Strongly form, line, and color-dominant minus deviations (i.e., adverse aesthetic impacts) would result from railroad construction that has to negotiate steep terrain: this would produce large cuts and fills whose crescent-shaped form would be foreign to the natural terrain. Form-dominant minus deviations would also result where railroad cuts that intersect natural terrain at a sharp angle can be viewed parallel to the rail's alinement. Natural edges would be formed where vegetative types change, where different slopes intersect, and on the periphery of agricultural fields. Railroad routing that failed to borrow from these natural lines would create line-dominant deviations from the characteristic landscape. Failure to successfully revegetate all land disturbances would additionally produce minus deviations in color.

Proposed bridges over Highway 13 and Williams Fork River would be potential minus deviations from the characteristic landscape. Reflective surfaces, intrusive colors, and inharmonious design are all factors that would increase the bridge's adverse impact. This would also apply to the proposed underpass at the proposed crossing of County Road 51 near the Taylor Creek crushing and loadout facilities.

Especially adverse impacts would result from very visible cuts and fills proposed adjacent to the viewshed sequences listed in Table GRIII-6; this table indicates the size (height or depth) of the cut or fill. Entries are numbered moving south on Route A.

TABLE GRIII-6

Route A -- Summary of Significant Cuts and Fills

Number	Landscape visual unit classification in which case cut or fill occurs	Direction of view (s)	Cut or Fill	Size (ft.) (height or depth
1	fg. UV and mg St	S	Cut	80
2-4	fg. VW	E	Fill	90
		W	Fill	75
		W	Fill	40
5	fg. VW & fg/mg WX	N & S	Cut	50
6-8	fg. WX	N & S	Fill	30
			Cut	40
			Cut 60	
9-11	mg. CB, DE	E	2 Cuts	70
	& mg. AC, DE		1 Cut	30
12-13	fg., DE, mg EF	S	Fill	20
			Cut	25
14	mg. BC, DF	S	Fill	20
15	mg. DE	S	Fill	20

(The remaining cuts and fills listed below may be viewed by boaters on the proposed Juniper Reservoir.)

16	(listed moving downstream	fg/mg	Cut	35
17		fg/mg	Cut	20
18		fg/mg	Cut	20
19		fg/mg	Cut	50
20-21	(Same as Nos. 9-15 above)	fg/mg	2 Cuts	2-70
22		fg/mg	Cut	30
23-24		fg/mg	2 Fills	2-30
25		fg	Cut	25
26		fg/mg	Fill	20
27-30		fg/mg	4 Cuts	4-30
31-32		fg/mg	2 Cuts	2-40
33		fg/mg	Cut	30
34-35		fg/mg	2 Cuts	2-50
36	(bridge across Milk Creek)	fg	Fill & Bridge	65
37	(along Milk Creek)	fg	Cut	45

SOURCE: W. R. Grace and Co., Feasibility Study for Coal Haul Railroad, October, 1974, prepared by Morrison-Knudsen Co. Inc.

No similar analysis of the section of Route A (shared in common by all three alternates) in Axial Basin is possible, as the feasibility report was completed with this portion routed up Wilson Creek; this route has since been abandoned. However, no cut nor fill on the formerly proposed Wilson Creek route exceeded 30 feet; this is indicative of the gentle grades also encountered on the present proposed route paralleling Jubb Creek. But especially significant impacts might result from cuts on the steep hillside immediately adjacent to the present alinement's entrance into Taylor Creek Canyon. Views to the landscape visual units across which this segment Route A is to cross are available from viewshed sequences No, HN, HIS and GHM.

If the proposed Juniper Reservoir is constructed, significant adverse impacts from especially severe cuts and fills would be realized through their increased visibility; an additional 15 cuts and fills would become visible in foreground landscape visual units. Seven additional cuts and fills visible from roads would also be visible from the reservoir.

Gravel bars on benches above the river proposed to be used for fill material would be sources of additional minus deviations, especially of form and texture.

Quantification of impacts in terms of numbers of people viewing these impacts is possible through analysis of the Average Daily Traffic volume figures found in Chapter II. Additional quantification necessary to evaluate the visual impacts Route A would have on potential boaters on proposed Juniper Reservoir is also included in Chapter II.

If vegetation that is cleared during road or railroad construction is scattered adjacent to the disturbed areas, or piled and burned, it could produce an aesthetically unconforming landscape of forest litter.

Disposal of refuse and waste from the railroad construction operation could also produce an undesirable landscape of litter if it is not properly disposed of.

The overall aesthetic experience along the railroad area would also be adversely impacted. Descriptions of mood-atmosphere reactions are subjective and vary from one person to another. The natural character of the railroad corridor along Route A unquestionably kindles feelings of isolation, solitude, or respect for nature, especially where Route A traverses ten miles of largely undisturbed natural terrain in Little Yampa Canyon (from the confluence of the Yampa River with Williams Fork River to its confluence with Milk Creek, see Chapter II). The railroad would result in adverse impacts to these values as well as those which produce isolation and solitude; this would be the first significant man-made element in the canyon.

Engineering and construction expertise which make this routing possible might simultaneously result in beneficial impacts to mood-atmosphere values by revealing nature's complexity and grandeur, at least to some viewers.

Recreation

Adverse impacts upon wildlife viewing potentials would result from displacement of sage grouse from strutting grounds; the proposed Route A would go directly through a sage grouse strutting ground in Section 21, T.6N., R.91W. (see Chapter III, Terrestrial Fauna).

Railroad construction proposed along the Yampa River and Milk Creek would result in increased sedimentation and siltation in these streams; their inherent capabilities to attract and sustain fishing use would be adversely impacted by the proposed action. There would be an especially significant adverse impact upon recreational fishing capabilities (see Chapter III, Aquatic Fauna) along Milk Creek, where significant re-chanelization would be necessary (four segments are proposed).

Construction of Route A would damage natural values in the largely undisturbed Little Yampa Canyon; as a result of this, Wild and Scenic River classification potential of this section of the Yampa River would be reduced from "Scenic" to "Recreational." This projected impact is based solely on observed resource values in relation to established Wild and Scenic River Classification guidelines.

Railroad construction, as well as its subsequent operation, would influence the distribution of big game. The proposed routing of Route A across the Ellgen property in Round Bottom might displace deer from this acreage which is presently a privately-operated big game hunting area; especially if the right-of-way is fenced, it would interfere with the movement of deer between Iles Mountain and the Yampa River. Conversely, the railroad might attract deer to this area and beneficially impact hunting potential; successful revegetation efforts would attract game animals in search of browse. The right-of-way would nearly always be free of snow during winter months; this would also serve to attract deer.

Known as well as unknown cultural resources would be destroyed by the railroad's construction; they would thereby lose their human interest value and subsequent inherent capability to attract and sustain recreation use. This loss would occur through actual destruction of the resource both by railroad construction, and by vandalism and pot hunting by construction crews (see Chapter III, History and Archeology).

Beneficial impacts to the recreation resource would also result from an increased number of roads and trails proposed to serve as supply points during railroad construction; these would increase these land units' capability to attract and sustain off-road-vehicle (ORV) use. Beneficial impacts in these areas would result in snowmobiling in winter, and to trail bikes and four-wheelers in summer. This increased capability would be realized in areas of existing public access. Increases in ORV potential that are actually realized through on-the-ground use could result in secondary adverse impacts upon wildlife in the form of ORV harassment; this would decrease recreational wildlife potential.

Other beneficial impacts might be an increase in the availability of desirable rockhounding material from cuts in rock materials. Greater capabilities for geologic and industrial interpretation could be realized through construction of the railroad; existing public access points have potential for informing the visiting public of the physical and economic conditions resulting in construction of the railroad. This could be accomplished by interpretive signs and by interpretive-educational brochure development. Successful revegetation in foreground landscapes (see Chapter II, Aesthetics) would serve to attract greater numbers of big game, especially during the winter, when forage is scarce. There would be an accompanying increase in wildlife viewing opportunities.

Social Environment

Table GRIII-7 presents the population impact by county and community of the development of the W. R. Grace railroad; it also indicates expected new school enrollment by county. These data were generated by the gravity-employment multiplier model described in Chapter IV of the Regional Analysis (Future Social Environment Without the Proposed Action). They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

Requirements for new social support facilities including housing, health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table GRIII-7 indicates that development of the W. R. Grace railroad would induce a relatively small increase in population; therefore, impacts on existing social support facilities would be relatively minimal. It is the cumulative impact of several new developments that generates significant new requirements for social support facilities; these requirements are addressed in depth in Chapter V of the Regional Analysis.

There have been no expressions of local attitudes specifically oriented toward the development of the W. R. Grace railroad. Rather, attitudes are directed toward the subject of regional and community growth in general, and therefore are examined in Chapter V of the Regional Analysis.

There is very little residential use near the proposed railroad from its initial point south to the mine. Noise from passing trains, however, would have an adverse impact on those people living nearby. Property

TABLE GRIII-7

Population Impact of Grace Railroad Development

	1980	1985	1990
Direct Employment at railroad	29	29	29
New Population:			
Moffat County total	67	70	68
Craig	67	70	68
Rio Blanco County total	42	43	44
Meeker	42	43	44
Routt County total	8	8	8
Hayden	8	8	8
Total	117	121	121
New School Enrollment			
Moffat County	5	16	16
Rio Blanco County	6	10	10
Routt County	1	2	2
Total	12	28	28

TABLE GRIII-8

Economic Impact of Grace Railroad Development

	1980	1985	1990
Direct Employment at railroad	29	29	29
Induced Employment			
Moffat County	12	13	15
Rio Blanco County	8	10	12
Total	20	23	27
Direct Earnings	396	444	497
Induced Earnings			
Moffat County	92	141	189
Rio Blanco County	69	111	163
Total	161	252	352

Note: Earnings data in thousands of 1974 constant dollars.

values along the proposed route could be affected upward or downward depending on the intended use of adjacent lands.

For a more extensive analysis of the regional impacts, mitigations, and unavoidable adverse effects to which the development of W. R. Grace and Company's railroad would contribute, refer to the appropriate chapters of the Regional Analysis.

Economic Conditions

Table GRIII-8 presents the economic impact of development of the W. R. Grace Railroad in terms of employment and earnings. These data were generated by the gravity-employment multiplier model described in Chapter IV of the Regional Analysis (Future Economic Environment Without the Proposed Action). These data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from the W. R. Grace railroad development fall in Moffat County.

No adverse economic impacts would be expected to associate with the development of the W. R. Grace railroad because both the direct and induced employment and earnings would be relatively small compared to the economic base of the region.

Transportation Networks

When the mine is at its full output of 3.0 million tons per year, 326 unit trains of 92 cars of 100-ton capacity each would be fed into the D&RGW rail system per year, or an approximate average of less than one such train per day. The impact on the Craig branch of one unit train per day would be minimal. Proper scheduling would work this train into other traffic with little or no difficulty. Potential increases in levels of various pollutants affecting air and water quality are considered under the appropriate heading in this site specific analysis.

At-grade crossings, which are proposed for all farm and ranch access roads as well as for several county roads, present hazards of collision.

Probable noise along the rail line due to construction of the line (Table GRIII-9) and due to operation of the line (Table GRIII-10) has been estimated and quantified. The noise level figures for construction of the rail line would all be above the maximum permitted level set by the Colorado State Noise Abatement Act (Senate Bill 197) for industrial areas, which is 80 decibels at 25 feet or more from the sound source. However, the construction noise would be temporary in any one area and would only occur during construction seasons of the two-year construction period. Table GRIII-9 gives estimated operation-related noise levels at 100, 200, 400, 800, and 1000 feet from the rail line. For all five operating categories given, the noise level at 100 feet from the rail line (the highest for any given category since sound intensity abates with distance) would be well below 80 decibels. Although 25 feet from the rail line is not dealt with in this table, studies of noise level trends of railroads indicate that the level of 80 decibels should not be exceeded even at that distance.

The new railroad would extend the existing railroad network in the area and would thus have positive impact on area transportation.

TABLE GRIII-9

Typical Construction Equipment Sound Levels
(Decibels "A" - Weighted Sound Levels)

Equipment	Sound Level -dB(A)
Rock Drill @ 100 feet	92
Scraper - Loader @ operator station	117
Compressor @ 20 feet	92
Bulldozer @ operator station	103.3
Compactor @ operator station	116
Front Loader @ operator station	93
Grader @ operator station	88.7
Diesel Truck, 40 mph @ 50 feet	84

SOURCES: Ohio Environmental Health Association 1973 and Wayshak 1973.

TABLE CRIII-10

Estimated CNEL* Values at Various Distances for Railroad Spur Line Operations

Train Category	Train CNEL (dB)				
	100 ft.	200 ft.	400 ft.	800 ft.	1000 ft.
Level Grade - Mainline Track	58.04	54.04	48.61	42.74	41.11
Upgrade - Mainline Track	58.53	54.92	50.58	45.84	44.76
Downgrade - Mainline Track	55.58	51.58	46.07	39.57	37.71
Level Grade - Frog or Grade Crossing	63.37	59.37	53.54	47.26	45.40
Level Grade - Heavy Steel Trestle	65.10	61.10	55.22	48.87	46.95

* CNEL: Community Noise Equivalent Levels

SOURCE: VTN Calculations, Courtesy W. R. Grace, 1975

Chapter IV

Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF W. R. GRACE AND COMPANY'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN THE COMPANY'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS IN LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

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CHAPTER IV

Measures Included in the Applicant's Proposal

Geologic and Geographic Setting

Standard engineering practices would address slope-stability problems and would minimize failures, if detailed engineering studies along the proposed railroad route adequately identify problem areas.

Water Resources

Channel changes and water structures would be designed to accommodate 50-year floods. Riprap would protect all embankments that encroach on flood-flow elevations along streams and the proposed Juniper Reservoir. Riprap would be two feet thick normal to the slope and consist of rocks averaging 150 pounds. Drainage control would be a design objective to prevent roadbed undercutting and to avoid saturation of fill materials.

Air Quality

Watering of construction areas and access roads would reduce fugitive dust.

Terrestrial Flora and Soils

Reclamation procedures would involve establishment of a stable, self-perpetuating vegetative cover on lands disturbed by the railroad construction.

Wherever practical, topsoil would be stored and replaced on any Lewis or Mancos shale which would be disturbed, or on any areas which expose the "C" soil horizon or other strata unsuitable for plant growth, except for steep rock faces. It is doubtful that fertilizer would be required for this operation; however its usefulness would be evaluated during revegetation.

Seeding would occur as soon as practical after construction, and would be designed to coincide with optimum planting times, spring or fall. In some areas prone to erosion, such as steep slopes, winter wheat or another annual would be planted immediately for erosion control until the next optimum planting time, when a comprehensive seeding mixture would be applied.

Hydromulching or a suitable substitute for seeding would be used on slopes steeper than 25 percent, depending on slope length. A rangeland drill would be utilized for seeding surfaces that would accommodate farm equipment. Depending on slope angles, a scarification procedure would prepare a seedbed suitable for plant growth where hard flat surfaces would be created by dozers; steep surfaces of exposed rock would not be seeded.

Using the Soil Conservation Service's guidelines for revegetating disturbed areas, four seed mixtures have been recommended for different ecological conditions that would be encountered along the railroad route.

Their descriptions follow:

Recommendations for south facing slopes, steep topography and/or low rainfall

- Indian ricegrass
- Bluebunch wheatgrass
- Streambank wheatgrass
- Russian wildrye
- Needle and thread grass
- Sand dropseed
- Western wheatgrass
- Intermediate wheatgrass
- Yellow sweetclover

Recommendations for moderate moist and cold location (east facing areas)

- Smooth brome
- Mountain brome
- Hard fescue
- Western wheatgrass
- Orchard grass
- Bluebunch wheatgrass
- Slender wheatgrass
- Yellow sweetclover

Recommendations for areas in the Axial Basin

- Indian ricegrass
- Bluebunch wheatgrass
- Western wheatgrass
- Siberian wheatgrass
- Green needle grass
- Sand dropseed
- Streambank wheatgrass
- Russian wildrye

Recommendations for Taylor Creek area

- Timothy
- Smooth brome
- Big bluegrass
- Orchard grass
- Hard fescue
- Western wheatgrass
- Mountain brome
- Bluebunch wheatgrass
- Slender wheatgrass
- Yellow sweetclover

Depending on slope aspect, location, and degree, exact composition of species in each seeding mixture would be adjusted. Each mixture would total approximately 25 pounds of seed per acre, including a fast germinating annual (such as winter wheat or oats) to provide early competition for weed species, enhance soil stability, provide shade for perennials, and provide quick establishment of green cover. In areas of high wildlife and livestock use, an attempt would be made to utilize unpalatable species in the seeding mixture to discourage stock and wildlife activity immediately adjacent to the railbed. Seedlings might fail due to various adverse climatic conditions; if so additional seeding would be done to help establish and maintain vegetative cover.

Terrestrial Fauna

W. R. Grace has proposed to seed all disturbed areas as soon as practical after construction. This would help mitigate impacts on the fauna created by the loss of vegetation. In areas of high wildlife and livestock use, an attempt would be made to use unpalatable species in the seeding mixture to discourage stock and wildlife activity immediately adjacent to the railbed.

Areas of the right-of-way that prove hazardous to wildlife or livestock would be fenced. In other areas where the landowners might request fencing of the right-of-way to protect livestock, the fences would be designed to limit livestock but not hinder deer, elk, and antelope movements.

Every effort would be made to cease or minimize railroad construction in the Big Bottom area during spring season when sandhill cranes would be nesting. Sage grouse strutting grounds would be located prior to railroad construction, and every effort would be made to cease or minimize construction when grouse are strutting. The timing of construction in the areas of sandhill crane and sage grouse activity would be coordinated with the Colorado DOW. Most of the train traffic would be during daylight hours; this would help reduce the probability of animal-train collisions.

Aquatic Biology

The use of riprap where the roadbed encroached on streams would minimize sediment additions and therefore minimize adverse impacts on aquatic species and habitat.

Aesthetics

Except for rock faces, all railroad construction disturbances would be revegetated with a self-perpetuating vegetative cover; this would help mitigate the strong line and form dominant nature of railroad and access road construction scars. However if species dissimilar to those on immediately adjacent terrain would be used there would be deviations from the characteristic landscape in terms of texture and color.

Recreation

Reclamation of all railroad construction disturbances by revegetating cuts and fills (and by riprapping for bank stabilization adjacent to Juniper Reservoir if it is constructed) would significantly reduce downstream siltation. This would help prevent degradation of downstream fishing capabilities of the Yampa River.

Transportation Networks

At-grade crossings would be provided for all private and county roads. These crossings would include cattle-guards to protect livestock, and signs to warn users of the road. Adequate sight distances would be included in designs of county road crossings to reduce collision hazards.

Measures Required by Law or Regulation

The various laws and regulations mentioned in the Regional Analysis that apply to all kinds of actions, including railroad rights-of-way, include water and air quality standards, reclamation standards, protection of archaeological and historical values, protection of endangered species, employee safety requirements, noise level standards, etc. A few are concerned specifically with rights-of-way and railroads.

Geologic and Geographic Setting - Paleontology

On July 10, 1963 the Regional Solicitor at Salt Lake held "that fossils are covered by the Antiquities Act but such coverage extends only to such fossils which are of an actual and real historic or scientific interest and of some unusual significance" (Associate Solicitor, Division of Public Lands, October 13, 1971). Title 43 CFR 6010.2(b)(2) prevents removal of ". . . objects of antiquity, historic, or scientific interest. . . " However, Section 6010.2(a) does allow for collection of common invertebrate fossils, rocks, and gem stones for personal use, consumptions, or hobby collection.

Terrestrial Flora and Soils

In Title 43, Code of Federal Regulations, Subpart 2801.1-5, terms and conditions are set forth that would be used as the basis for stipulations to lessen impacts on soils and vegetation. By accepting a right-of-way across Federal lands, the applicant agrees and consents to comply with the following condition:

> To take such soil and resource conservation and protection measures, including weed control, on the land covered by the right-of-way as the superintendent in charge of such lands may request.

Measures provided by Regulation No. 1, Section 9, Emission Control Regulations for Particulates, and Sulphur Oxides for the State of Colorado that control fugitive dust, such as watering during construction, would reduce the impact of fugitive dust on vegetation.

The Endangered Species Act of 1973 provides for the conservation, to the extent possible, of plant species facing extinction. If species in this category were found along the proposed railroad route their protection would be provided for by enforcement of this act.

Terrestrial Fauna

The Endangered Species Act of 1973, makes it unlawful to, in any way, harass an endangered species. Peregrine falcons (_Falco_ _peregrinus_) have been seen in the general vicinity of the proposed route. Therefore, to help mitigate any potential harassment of this species a study would be conducted prior to the beginning of any construction. This study would identify all endangered species habitat and use areas, or prove that endangered species do not use the subject area.

Aquatic Biology

The Endangered Species Act of 1973, makes it unlawful to, in any way, harass an endangered species. Every effort would have to be made to insure that the four endangered species of fish would not be affected by this action. No construction activities that would result in increasing the Yampa River's sedimentation load during periods of low flow, primarily July and August, would be allowed. During periods of high water and high sediment load, in the spring, the increase in sediment created by the railroad would not seriously affect the endangered fish species.

A supplement to the Endangered Species Act of 1973, published in CFR 40, 78-22 April 1975, clearly defines the parameters of this act.

Basically it would forbid any Federal agency from approving any action which would adversely impact an endangered species.

Archeological Resources

Legislative backing for protection of archeological resources comes from a variety of legislation. The Regional Analysis contains a detailed account of these regulations which are only summarized in this section.

The 1906 Federal Antiquities Act makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object, and it requires the issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation.

Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic Preservation Act; the Advisory Council on Historic Preservation is also established by the Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act).

The National Environmental Policy Act of 1969 (NEPA) also identifies the Federal government's continuing responsibility to preserve important historic and cultural aspects of our national heritage.

Establishment of the Federal government in a leadership role of preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970.

Protection of cultural resources on the State level is given by the Colorado Antiquities Act of 1973, which is essentially a parallel form of the Federal Antiquities Act. The Colorado Land Use Act of 1974 further authorizes local governments to designate cultural resources as areas of State interest with commensurate protection.

Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 which requires protection of cultural resources affected by any Federal or federally licensed construction project.

Two relatively recent solicitors' opinions further clarify the law's intent. An opinion issued in September, 1974, declares with respect to privately-owned surface acreage underlain by Federal mineral and coal lands, that the Section 106 Advisory Council review provisions are applicable. In addition it states that BLM has a NEPA responsibility to identify and consider the effects of its programs on cultural resources of these lands. Lastly the final responsibility for inventory and nomination to the National Register of cultural resources on these lands rests with the agency responsible for approving the potentially impacting action, which is the BLM.

A second solicitor's opinion of April, 1974, indicates that professional cultural resource surveys must be required as a part of the applicant's mine plan.

In order to identify all cultural resource values adequately to satisfy Section 106 requirements of the 1966 Historic Preservation Act, an intensive archeological survey must be completed. Dr. Lischka's intensive cultural resource survey fulfills the law's requirements.

For all practical purposes, not all cultural values having surface evidence were identified in the required survey. This is evidenced by the fact that Dr. Jenning's reconnaissance survey revealed a few additional sites along the proposed route. In addition other sites may be buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources due to increased visitor use pressure.

Historical Resources

All current antiquities legislation enumerated in the Archeological Resources section is also applicable to protection of the area's historical resources.

Aesthetics

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. These measures can be implemented to reduce atmospheric haze that results from airborne pollutants and particulates.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. The waters of the Yampa and Williams Fork Rivers, and of Taylor and Wilson Creeks are thereby required to be free from the aesthetically damaging effects of floating debris, scum, and discoloration.

Impacts to mood-atmosphere values that would be caused by increased noise levels would be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971) which establishes maximum permissible noise levels and abatement procedures. Federal noise pollution guidelines are outlined in P.L. 91-604, The Clean Air Act, Section 401 -- Noise Pollution and Abatement Act of 1970. The Office of Noise Abatement and Control, established by this Act, provides for enforcement of the guidelines contained in the Act. Enforcement of these laws would lower noise levels adjacent to railroad construction activities.

The above legislative acts would be effective only to the extent that they are enforceable, that the standards set forth are enforced, and that these minimum standards would indeed be effective in reducing impact. The probability of all of these actually being enforced, on the ground, would be something less than 100 percent, as evidenced by impacts presently occurring from similar coal related operations in the region.

Recreation

Water quality standards established by the Colorado Department of Health (1974) also provide regulations that would be used to mitigate impacts on recreation resources. All State waters should be free of substances or conditions that are toxic to plant, animal, or aquatic life, that produce undesirable aquatic life, and that import any undesirable taste to fish flesh, or make fish inedible. These regulations prohibit railroad construction-caused damage to the recreational potential of downstream fisheries.

The recreational value of archaeological and historical resources would be protected by enforcement of the provisions of current Federal and

State Antiquities Legislation. These include The Federal Antiquities Act (S.4698, June 8, 1906) which makes it illegal to appropriate, excavate, injure, or destroy any object of antiquity; this act also requires issuance of permits to qualified applicants for survey or excavation on Federal lands. The Historic Preservation Act (P.L. 89-665, October 15, 1966) establishes the National Register of Historic Places; it also requires a review of all Federal actions affecting existing National Register entries by the President's Advisory Council on Historic Preservation. Executive Order 11593 (May 13, 1971) expanded P.L. 89-665 to provide a review of any Federal action affecting properties eligible for inclusion in the National Register of Historic Places. Section 101(b)(4) of the National Environmental Policy Act of 1969 (P.L. 91-190, January 1, 1970) directs the preservation of "important historic, cultural, and natural aspects of our national heritage. . ." The Archaeological and Historical Data Conservation Act of 1974 (P.L. 93-291, May 24, 1974) provides for the preservation of antiquities "which might otherwise be irreparably lost or destroyed as a result of any alteration of terrain caused as a result of any Federal construction project or federally licensed project, activity or program."

The Colorado Antiquities Act (H.B. 1569) reserves all antiquities on State owned lands to the State of Colorado and prohibits the destruction, appropriation, injury or excavation thereof; permits are also required for qualified applicants to conduct surveys.

The degree to which these legislative enactments would be successful in mitigating impacts would be dependent upon their enforceability and actual on-the-ground enforcement. Based upon past observations of similar coal mining operations, enforcement of current laws has not been completely effective in mitigating applicable impacts.

Transportation Networks

Federal and State regulations and standards apply specifically to safety in designing and operating railroads. These cover: locating highway crossings to reduce potential for car-train collisions, erecting adequate signs and signals at crossings, requiring certain safety equipment on trains, and implementing accepted engineering standards in design and construction of the railroad (for example, American Railway Engineering Association standards.)

Measures to be Included if Authorizations are Granted

Geologic and Geographic Setting

Design specifications would include earthquake resistances for bridges and fills to mitigate the adverse impacts of increased seismic activity related to Juniper Reservoir. Construction of the reservoir is not a certainty and reservoir-caused seismicity is only a remote possibility; therefore the risk is low. The hazard, however, is sufficiently dangerous to merit concern.

Water Resources

Wells in or adjacent to the right-of-way and adversely affected by construction would be replaced or otherwise returned to their original effectiveness.

The adverse impacts that would result from sediment yield associated with erosion from cuts and fills are covered under the applicant's proposal. Additional precautions, such as settling ponds in affected tributary drainages, would farther reduce the introduction of sediment due to construction activities. Some additional precautions would be particularly important during periods of low flow when the stream normally has a very low sediment discharge and the impacts on aquatic life would be most adverse.

If channel widening were done during periods of low flow, the excavation would not extend beyond the water's edge into the low flow channel of the stream; a small amount of unexcavated material would be left alone, so the stream would not be directly disturbed. This unexcavated material would be removed by natural erosion processes during the next period of high water, at a time when the additional turbidity would not have as much impact.

If it should be necessary to place fill directly into the stream channel during periods of low flow, the fill would consist of rock below the water level in the stream. This would minimize the amount of material that would go into suspension. Fill that would be placed on top of the rocks would contribute little turbidity to the stream. However all direct sediment-generating activities such as placement of any kind of fill in the channel of the Yampa River would be avoided during July and August; this is the critical spawning period for many fish including the endangered species.

During channelization, erosion of the new channel would be reduced by placing rocks in the channel to increase the roughness. This procedure would be followed where the bed materials in the new channel are easily erodible.

After the foregoing mitigating measures are added to those proposed by the applicant, sediment yield from cuts and fills will be reduced by 75 percent or 1,600 tons after the first year, and the sediment resulting from channelization should be reduced by 90 percent or 1,700 tons after the first year, for a total reduction of 3,300 tons of sediment. The sediment yield figures for the first year following construction would be essentially unmitigated.

Air Quality

Specific mitigating measures need not be required unless the cumulative emissions of pollutants in the entire region become sufficiently large to influence air quality (see also Regional Analysis).

Soils

Mechanized equipment such as scrapers would be used to remove and stockpile topsoil to minimize soil mixing. Restriction of unnecessary off-road vehicle use by equipment operators and employees would also minimize compaction. Soil erosion would be minimized by mulching, development of erosion structures including waterbars, terraces, contour furrows, and interceptor ditches to divert running water away from unprotected disturbed areas.

Topsoil would be removed from borrow areas and replaced after fill material removal.

Terrestrial Flora

Studies and investigations would be implemented to identify productive downstream areas that are presently sustaining desirable vegetative communities and measures taken to insure that water is not diverted from these areas.

Service roads, material sites for sand, gravel, and ballast, campsites, and equipment storage areas would be cleaned up, reshaped, topsoiled, and revegetated. Contingency plans would include measures to clean up accidental spillage of detrimental or toxic materials such as gasoline, oils and chemicals, and to restore damaged vegetation to a near natural condition.

Edges or sides of all excavated material sites and borrow areas will be sloped to a minimum 3:1 slope to minimize sloughing and enable revegetation. Some slopes in rock excavation may approach 1:1 slopes.

In areas where water is available, irrigation would also increase reclamation success, especially in years when precipitation is low.

Terrestrial Fauna

Efforts would be made to avoid any construction related activity within the riparian habitat. This action would help mitigate impacts on the most important wildlife habitat found along the proposed route.

Access and maintenance roads would be kept to a minimum to avoid any unnecessary habitat disturbance.

Topsoil to be stockpiled would be placed where it would create the least damage to wildlife values. Soil stockpiled on bare ground, cropland, or in sagebrush habitat would avoid disturbing mountain shrub or riparian areas.

Aquatic Biology

If construction were to occur during periods of low flow, any widening of the Yampa River Channel would not extend beyond the water's edge; a small amount of unexcavated material would be left so the river would not be too directly disturbed. This unexcavated material would be removed by natural erosion during the next period of high water, at a time when the additional turbidity would cause no significant impact on the aquatic fauna.

If it were to become necessary to place fill material into the Yampa River during periods of low flow, no fine material that would cause an increase in the turbidity would be allowed. The fill would consist of large rocks until the fill has raised above the river's water level. This would help mitigate impacts of increased sedimentation on the aquatic fauna during these critical periods. To mitigate potential impacts to the aquatic biota resulting from train derailment, it would be necessary to plan the route so the spillage would not reach the aquatic ecosystem.

A high degree of line maintenance and an adequate mobilization plan for spill containment would also help mitigate these potential impacts.

Archeological Resources

Archeological values derive their primary value from being preserved in-place; their secondary value occurs as an archeological dig. No archeological testing nor excavation that stems from intensive surveys on proposed action areas would be permitted unless the site is in imminent danger of being destroyed. This would preserve the site's primary value and subsequent educational-interpretive values as well. It would also allow utilization of improved archeological survey and analysis techniques should the site be excavated at a future date when more sophisticated techniques would be employed in the excavation. For all practical purposes, this guideline might not be followed for especially significant sites.

Specific to proposed Route A, testing and subsequent excavation (if desirable) would occur, but only be permitted on the sites subject to partial or complete physical displacement (see Table GRIII-5); it should especially not be permitted on sites eligible for nomination to the National Register and not in imminent danger of displacement by the railroad.

All sites being identified as being eligible for nomination to the National Register (see Table GRII-6) should indeed be nominated. Protective fence exclosures and interpretive signing, both of a design that maintains the site's integrity, would be used as needed to help protect these sites.

Impacts to subsurface archeologic values would be partially mitigated by requiring that an archeologist accompany construction crews working in recently deposited alluvium suspected of containing subsurface values. This is usually done at the recommendation of the surveying archeologist. Not all subsurface resources would be found in this manner, for there is no foolproof method for determination of subsurface archeological potential.

Given the high concentration of archeological sites adjacent to recently deposited alluvium, an archeologist would accompany construction crews when they are excavating alluvial material. Should any significant site be found, appropriate salvage excavation would ensue.

Historical Resources

Historical values also derive their primary value from being preserved in-place; their secondary value is realized if they are excavated. To mitigate impacts to the George Iles Ranch (number 12, Table GRII-6), the buildings would be moved to another locale and the sites excavated.

No other historical sites would be either moved nor excavated unless they are subject to complete or partial physical displacement. However, an Historic and American Buildings Survey (HABS) would be completed to record any historic site prior to on-site destruction, regardless of their special significance (essentially a photographic documentation).

Aesthetics

All cut and fill slopes would be graded into a curving form that intersects adjacent undisturbed terrain at a very low angle to avoid sharp angular minus deviations of form and line.

Where large cuts would occur on steep side slopes, the alinement of the railroad would be shifted away from the hill; the rail right-of-way would be constructed largely of fill material to minimize the cut scar. This mitigation would especially reduce visual impacts if Juniper Reservoir is constructed; most riprapped surfaces of the fill would then be underwater. The strongly line and form-dominant horizontally oriented rail could very readily borrow from the light colored bleach line that would develop at the water's edge as a result of water level fluctuation.

If Juniper Reservoir is not constructed, potential impacts in Little Yampa Canyon would not be mitigated by shifting the alinement of the railroad; encroachments would extend either up the hillside above the railroad or down into the river below it, or both. These minus deviations would then be viewed only by potential river floatboaters (see Chapter II) except where County Road 30 provides visual access to them.

All disturbances would be successfully revegetated with native species found on immediately adjacent terrain; special attention would be given to revegetation of those cuts and fills listed in Table GRIII-5.

All bridge structures would be constructed of simple design to minimize the creation of lines and forms that compete with those found in the characteristic landscape. All surfaces would be painted a non-reflective earth-tone brown, buff, or green color characteristic of the adjacent landscape. These colors would also be used on fencing materials for fences that would be viewed at foreground distances.

Recreation

All railroad right-of-way and access road disturbances would be successfully revegetated immediately after construction. No access roads for railroad construction nor for railroad maintenance would be constructed on areas of steep terrain or fragile soils.

Prior to initiating any railroad construction, cultural resources lying on national resource lands would be nominated to the National Register of Historic Places as per Executive Order 11593 (May 13, 1971) to determine their eligibility for inclusion in the register. As directed by the 1966 Historic Preservation Act, the Advisory Council on Historic Preservation would be consulted prior to the initiation of any cultural resource-disturbing activities involving resources of National Register significance. This includes the action of archaeological excavation and salvage. Other locally significant cultural resources would also be protected for their recreational value even though they may not meet National Register criteria (see Chapter IV, History and Archaeology). No railroad construction personnel would be permitted to remove or vandalize any object of historic or archaeologic interest.

A qualified archaeologist would accompany construction crews on-the-ground to locate and identify significant buried cultural resources discovered during the actual construction operation. He would accompany the construction crews when they are working on alluvial material.

No fences would be constructed along the railroad right-of-way which would impede normal movements of big game between adjacent terrain and the river.

New access roads and trails for construction purposes would be physically blocked to ORV use, if these roads lie in known big game concentration areas, or if they traverse areas having fragile soils.

Transportation Networks

Although diesel locomotives rarely leave the rails and fall into water courses, procedures for prompt and efficient clean-up, which have been worked out by the D&RGW Railroad and the EPA, would be part of operating practices.

Coal dust from hopper cars would be minimized by baffles designed to control air flow around coal loads.

Diesel locomotives would be equipped with pollution control devices to reduce emissions.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF W. R. GRACE AND COMPANY'S PROPOSED ACTION THAT WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

CHAPTER V

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Geologic and Geographic Setting

Adverse impacts on the region's topography that cannot be avoided would be the cuts and fills along the proposed route of the railroad, and the pits for ballast gravel and borrow materials.

Paleontology

Impacts to all fossils would be difficult to mitigate; some would most certainly be destroyed. Generally speaking, these losses would not be significant, given the existing knowledge of the area's lithology.

Mineral Resources

If there is coal beneath the right-of-way, it would be unavailable for surface mining during the life of the railroad.

Water Resources

Recharge areas for ground water would be lost beneath filled parts of the right-of-way, but the effect of the loss on total recharge capabilities would be insignificant.

New discharge areas from ground water could be created in cuts but the adverse effects would be small and localized. Nearby wells adversely affected by locally lowered water tables could be replaced (as mentioned in Chapter IV).

Approximately 4,000 tons of sediment produced during the first year of construction would be essentially unmitigated. This would be reduced during subsequent years, to about 700 tons per year, as a result of mitigating measures and the natural stabilization of cuts, fills, and stream channels.

Because the normal sediment load of the Yampa River is about 300,000 tons per year, neither the initial sediment increase nor the continuing additional sediment input would cause an appreciable change in the amount of sediment in the stream.

Spillage of coal or diesel fuel into streams as the result of accident would be a possibility that could not be completely avoided. Accident data are presented in the Transportation Networks section of this chapter of the statement.

Air Quality

Fugitive dust from construction, although temporary and local, at times probably would exceed the 24-hour standards for suspended particulates, unless rigorously controlled by watering. Emissions from construction-related vehicles would have a minimal but unmitigated adverse effect on air quality.

Emissions from diesel locomotives during railroad operations also would have a minimal but unmitigated adverse effect on air quality. The emission levels expected are shown in Table GRIII-1.

Soils

Disturbance of soil on 440 acres during construction would not be avoided. Soil disturbance would lower productivity of the disturbed area to some degree by compaction, mixing of native soils, and accelerated erosion.

Partial alteration of all soil horizons, parent material, and soil characteristics which have developed over long periods of geologic time could not be avoided. Present soil biota and soil forming processes would be altered. As a result, new soils would be formed with characteristics unlike those existing prior to disturbance.

Terrestrial Flora

Railroad construction would unavoidably disturb approximately 440 acres of vegetation. A minimum of 70 acres of vegetation would be occupied by the roadbed and would be permanently lost. Twelve acres would be permanently lost to community expansion due to population increase associated with the railroad. Approximately 80 percent of the remaining disturbed acreage, almost 300 acres, would not be revegetated because of steepness, rockiness, and areas provided for snow removal in cuts; these areas would be permanently void of vegetation. The remaining 20 percent of the right-of-way, approximately 66 acres, would be revegetated; however the loss of vegetation for as long as four years could not be avoided. Even after revegetation, a return to present native composition would be indefinite, making the loss of native vegetation an unavoidable impact for at least 20 years. Some weed invasion would be unavoidable.

Croplands severed by the right-of-way would be an unavoidable impact that would result in increased difficulties for farming.

Some damage from dust fall on vegetation would be unavoidable during construction of the railroad, but it should be local and temporary if dust control practices are rigorously followed.

Terrestrial Fauna

Some destruction of wildlife habitat could not be avoided. Food, cover, dens, and nests would be lost during the railroad's construction phase; few animals would be displaced because of these activities. The number of animals displaced is not considered to be great enough to cause a significant alteration in the existing ecosystem except perhaps in the riparian habitat type. Riparian vegetation is restricted to a relatively small strip of land winding through this region. The loss of approximately 115 acres of this habitat type would create a significant impact on some wildlife species. However, the proposed action would disturb riparian habitat that may be flooded by the proposed Juniper Dam.

About 440 acres would be disturbed, of which approximately 370 acres would be taken out of production permanently because of the railroad bed construction. This reduction would result in a loss of habitat capable of supporting seven mule deer, three elk, and possibly three pronghorn antelope, between Craig and the terminal in Axial Basin. A corresponding loss in the area's carrying capacity for a variety of small mammals, domestic livestock, non-game birds, reptiles, amphibians, and invertebrates also would be unavoidable.

Disruption in migration patterns of big game species could take place during the construction period; however this probably would not have long lasting impact on the migration routes unless there were a major increase in rail traffic.

Noise associated with railroad construction and operation would create an unavoidable impact on terrestrial fauna; the long-term impact should not be significant unless there would be a major increase in rail traffic.

Fences along the right-of-way would unavoidably impact some large animal movement across, and use of, the right-of-way forage. Vehicle and train collisions with large and small animals would be unavoidable even with fencing as proposed. A discussion of this adverse impact is addressed in Chapter III.

Aquatic Biology

Increasing stream sedimentation would be impossible to avoid during the construction of the proposed railroad. After the completion of the railroad's construction the sedimentation impact would be greatly reduced and would become very slight after a year or two. Construction along the proposed route would have an adverse impact on the quality of the aquatic habitat in the Yampa River. Exposure of frangible soils on steep slopes directly above the Yampa, as well as numerous encroachments of fill material into the river bed would, despite mitigating measures, cause some sedimentation increase during the construction process. These adverse impacts would result from accumulation of silt in rocky riffle areas which serve as fish spawning and feeding areas and from direct harmful effects of increased sedimentation on individual aquatic organisms (e.g., many sedentary benthic invertebrates would perish due to the suffocating effects of the silt deposition over their habitat). If the proposed mitigating measures are not fully implemented, the resulting degradation of the aquatic habitat could be construed as a violation of Section 9 of the Endangered Species Act of 1973 (Public Law 93-205; 93rd Congress; S. 1983; December 28, 1973).

In addition, deposition of fill material into Yampa River would result in some alteration of the normal flow characteristics (volume and velocity) of the Yampa River. This would alter the composition of the aquatic ecosystem, particularly the benthos.

Archeological Resources

Complete loss of 25 lithic sites, three chipping sites, and three campsites, and partial loss of an additional five lithic sites and one rock-shelter would be unavoidable. Archeological testing and subsequent excavation (if desirable) would lessen the loss, but their in-place value would be lost. The value of other less significant sites (not warranting testing nor excavation) would be totally lost.

The impact to all sites from increased exposure to vandalism and pothunting would be unavoidable; except that interpretive signs and fence exclosures should be effective in protecting those sites eligible for nomination to the National Register.

Destruction of unknown subsurface resources would also be unavoidable; the significance of this impact would depend upon the nature of the unknown resources.

Historical Resources

Complete loss of three building sites and one rock structure site would be unavoidable, except for values retained by relocation of the buildings and by salvage excavation, if minor realinements of the railroad cannot be successfully negotiated. Impacts on historical values from theft and vandalism would be unavoidable.

Aesthetics

Given the foregoing mitigating measures, the net residual of adverse impacts could be somewhat reduced. However, the proposed action would unmistakably alter the characteristic landscape in the form of adverse impacts. For all practical purposes several visually incongruous elements or minus deviations would not be mitigated.

Due to the proximity of Route A foreground landscapes to the viewshed sequences providing visual access, and due to rather rigid engineering standards which must be met, mitigations could only lessen adverse visual impacts slightly. Cuts and fills would still remain as large-scale elements in these landscapes; but their harsh form could often be partially mitigated by careful grading and by successful revegetation. However, where cuts and fills would be built on solid rock, chances for revegetation would be nil. Special engineering designs and painting of bridge structures would also result in some mitigating effect, but adverse visual impacts from these structures could not be totally avoided.

Adverse impacts upon mood-atmosphere values of isolation, solitude and respect for nature could not be mitigated; these would remain significant, especially in Little Yampa Canyon.

Recreation

Impacts to the sage grouse strutting ground adjacent to Big Bottom would not be mitigated; they would be displaced from this strutting ground.

Increased sedimentation and siltation in Yampa River and Milk Creek would be unavoidable given the size of proposed cuts and fills, the steep and often precipitous slopes and the proposed re-channelization on Milk Creek. Successful re-establishment on all disturbed areas would not be possible as many would occur in the form of exposed rock faces and talus slopes. The overall result would be a decrease in the inherent capability of these streams to attract and sustain fishing use.

The destruction of cultural resources would be unavoidable. The degree of unavoidable impact would be determined by the significance of the site being destroyed. Excavation prior to railroad construction would only partially mitigate this impact because salvage archeology and excavation are inherently destructive actions; they destroy the in-place value of the resource.

Impacts on and loss of natural values in Little Yampa Canyon, along the Yampa River, would be unavoidable, as well as impacts upon potential Wild and Scenic River classification.

The relative value of these unavoidable adverse impacts would be determined by the availability of other similar recreation opportunities in the region. Public values are directly involved when adverse impacts remain unavoided on national resource lands. On privately-owned lands, only the landowner is immediately affected unless public rights-of-way provide access to that land (for example county roads). Impacts to unknown cultural resources have commensurate unknown values.

Transportation Networks

VTN has recently determined that during the 30-year life of the proposed project, the probability of at least one derailment near a water course would be close to 1/10 of one percent. A train derailment does not necessarily imply an engine derailment and subsequent diesel fuel spill into the adjacent water course. Although statistics are not available on what percentage of derailments include engine derailments and fuel spills, it can be assumed that the actual probability of a diesel fuel spill into a water course would be substantially less than the probability of a derailment. Whatever the probability of a diesel fuel spill into a water course, it must be assumed to be an unavoidable environmental impact of a rail line operation in this area. [1/]

Increased rail traffic on the Craig branch of the D&RGW Railroad as well as traffic on the proposed new railroad would have unavoidable adverse impacts. Noise generated by one unit-train per day each way would affect nearby residents. Hazards at grade crossings would be unavoidable however well the crossing were constructed and marked.

[1/] (VTN data courtesy of W. R. Grace).

Chapter VI

Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN W. R. GRACE AND COMPANY'S PROPOSAL. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF W. R. GRACE AND COMPANY'S PROPOSED ACTION TAKES PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

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CHAPTER VI

RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

Geologic and Geographic Setting - Paleontology

Unavoidable paleontological impacts would be experienced in the short-term during the railroad's construction. After completion of the railroad, no further impacts would occur.

Options for future use of these subsurface resources would be foreclosed by their destruction. However the operation itself could disclose knowledge of fossils heretofore unknown; this would create options for future generations to benefit from the newly-found resources.

Soils

Long-term productivity of soils would decline as the railroad is constructed and used. Some of this lowered quality would result from accelerated erosion of denuded and disturbed areas, but the greatest loss would result from mixing and burying soils during construction of the road bed. Soil development is a slow process under the best conditions and the present climatic conditions in the area magnify the time factor that would be necessary to redevelop a self-sustaining soil system. Loss in soil productivity would be a long-term loss on about 400 acres.

Terrestrial Flora

The short-term uses associated with the construction of the railroad would be the destruction of vegetation by construction of the right-of-way, the load-out facility, and access roads, plus the associated population increase. Approximately 440 acres would be disturbed during the construction phase, and approximately 66 acres would be revegetated, leaving nearly 400 acres that would not be returned to productivity.

The long-term productivity of revegetated areas would depend on the success of the proposed reclamation program and on natural succession.

Terrestrial Fauna

Short-term use of the proposed railroad right-of-way by wild fauna would be reduced because of temporary loss of about 66 acres of wildlife habitat and permanent loss of another 400 acres. All wild fauna species that have been identified as inhabiting the right-of-way would show a reduction in use of this area. The degree of reduced use by species would depend on the total acreage of each vegetation type disturbed.

The proposed action would cause a loss in short-term use of riparian areas, at least during the construction phase. Reduction in long-term productivity would depend on the success of revegetation efforts. Grasses would be the primary plant species used during reclamation; this would favor those faunal species associated with grasslands or those that require an increase of grasses within their habitat boundaries.

The proposed route would cross a major mule deer and elk migration route. Short-term use of these migration routes would be reduced or altered during railroad construction. The long-term effect of the railroad probably would not be significant unless the volume of rail traffic were increased.

Most of the railroad right-of-way through livestock use areas would be fenced to exclude domestic animals, eliminating short-term use of those areas. The fences would be expected to remain in place and in good repair for the life of the railroad, eliminating long-term livestock productivity.

Aquatic Biology

The construction of the proposed railroad line would adversely impact the aquatic habitat. Some of these impacts would be temporary, e.g. only during the actual construction phase. Other surface disturbances would produce adverse impacts until the complete re-establishment of ground cover vegetation.

Impacts on the rivers and streams would vary depending on the size of the body of water. Channelization of small streams would produce long-term impacts due to the nature of the small stream ecosystem and its intolerance to disturbance. Even when the small stream is able to re-establish itself, the benthic fauna and flora generally are greatly altered.

Large rivers, because of their size and ever-changing configuration, are more tolerant to in-stream impacts. Those species of vertebrates, invertebrates, and plants that are endemic to this environment have evolved this adaptability and tolerance or they would not be present.

Archeological Resources

Archeological values, both known and unknown, would be impacted during the short-run by actual surface disturbance. Potential for vandalism would be experienced largely in the short-term.

Options for future use of cultural resources would be foreclosed by the degree of unavoidable impact from building the railroad. However, required testing and salvage excavation could reveal presently hidden values; this would create options for future generations to benefit from the newly-found resources.

Historical Resources

Unavoidable impacts upon historical resources would occur only in the short-term. Once the railroad is built, the potential for vandalism and destruction of the old buildings and structures would return to its present state.

Aesthetics

The phrase "short-term" encompasses the time-frame of the proposed action, 1976-1978. Given the foregoing mitigating measures, short-term impacts would be only somewhat reduced. After 1978 long-term unavoidable impacts on the area's aesthetics would still remain (See Chapter IV), though they would be less significant than short-term impacts. However, long-term impacts would only be partially mitigated with the passage of time. Examples of adverse impacts, some of which could be mitigated in the long run, include gradual weathering of road cuts and fills and the ecological succession that would establish plant communities on them. Examples of adverse impacts unmitigated in the long run would include large cuts and fills and adverse impacts to mood-atmosphere values in Little Yampa Canyon.

Recreation

The phrase "short-term" encompasses the time-frame of the proposed action, up to 1978. Short-term use of the area would result in several adverse as well as beneficial impacts to recreation resources (see Chapter III). After 1978, many of these unmitigated would remain (see Chapter V). Potential increase of off-road vehicle use and additional wildlife viewing opportunities would improve recreation capabilities on a long-term basis if successful reclamation occurs. Management decisions

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would determine whether the potential for rockhounding and geologic-industrial interpretation would be realized; this realization partially rests on whether recreation users would have access to the proposed action areas.

Should the proposed Juniper Reservoir be constructed, public access along the Yampa River segment of Route A would be available; access would alternately be provided if the Little Yampa Canyon would be opened to public floatboating.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

THIS CHAPTER QUANTIFIES THOSE RESOURCES THAT WOULD BE CONSUMED AND PERMANENTLY LOST AS A RESULT OF THE IMPLEMENTATION OF W. R. GRACE AND COMPANY'S PROPOSED ACTION. SUCH LOSSES ARE IRRETRIEVABLE COMMITMENTS; I.E., ONCE THESE RESOURCES ARE USED, THEY CANNOT BE REPLACED.

CHAPTER VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Geologic and Geographic Setting - Paleontology

Approval of the right-of-way application would be an irreversible commitment of fossil resources. Those fossils unavoidably impacted would be irretrievably lost upon completion of the mining operation.

Mineral Resources

Coal

The small amount of coal destroyed along the railroad in cuts and under fills would constitute an irreversible and irretrievable commitment of resources. Coal bed resources lying too close to the surface and to be mined underground below the route, would be lost as resources for the life of the railroad. If underground mines would be opened in the future, long pillars left standing directly below the railroad to insure against subsidence would be an irreversible and irretrievable commitment of resources.

Gravel

As indicated in Chapter III, approximately 91,000 cubic yards of gravel from terrace gravels just south of Craig would be required as ballast for the railroad. Since this material could not economically be recovered if and when the railroad is abandoned, this would be an irreversible and irretrievable commitment of resources.

Soils

The original composition and productive capacity of the soils disrupted by railroad construction would be lost irretrievably.

Terrestrial Flora and Fauna

Approximately 400 acres of the railroad right-of-way would be irreversibly committed to use as a transportation corridor. The remaining 66 acres would be revegetated but probably would produce 50 percent less forage than undisturbed sites. Wildlife habitat and grazing values in this area would be irretrievably committed to transportation. Existing soil profile characteristics would be irretrievably lost on the 440 acres that would be disturbed by railroad construction.

Aquatic Biology

Aquatic habitat would be irretrievably committed to the proposed railroad construction to the extent that channel changes would destroy habitat and that sediment additions to the streams would alter existing habitats.

Archeological Resources

Unavoidable impacts to cultural resources would constitute an irreversible commitment of these resources if the right-of-way application was approved. Upon completion of the railroad, unavoidable impacts would be irretrievably committed.

Historical Resources

Irreversible and irretrievable commitments of historical resources would occur as described in the section on archeological resources.

Aesthetics

Commitment of proposed Route A to construction of the W. R. Grace railroad would be an irreversible commitment of aesthetic resources relating to unavoidable and long-term minus deviations or adverse impacts. These residual impacts would be irreversible for all practical purposes regardless of their significance.

Recreation

Commitment of the proposed action area to railroad construction would result in irreversible commitments of recreational resources, even though they would be both adverse and beneficial. Destruction of unknown cultural resources for all practical purposes would be irreversible.

[illegible]

railroad would become [illegible]

relating to [illegible]

These residual impacts would [illegible]

restrictions [illegible]

[illegible]

[illegible]

result in [illegible]

that would be [illegible]

removed [illegible]

Chapter VIII

Alternatives to the Proposed Action

INCLUDED IN THIS CHAPTER IS A DISCUSSION OF ALL REASONABLE ALTERNATIVES TO W. R. GRACE AND COMPANY'S PROPOSAL. THE IMPACTS RESULTING FROM THESE ALTERNATIVES ARE ALSO ANALYZED IN THIS CHAPTER.

CHAPTER VIII

ALTERNATIVES TO THE PROPOSED ACTION

Alternatives to the proposed action are no action, alternate routes for a railroad, and alternate means of transporting the coal (truck, slurry pipeline, or conveyor).

No Action

"No action" here is defined as meaning not only that the proposed railroad would not be built but also that none of the alternate means of transportation would be used. The result of no action therefore would be, for all practical purposes, no development of the Colowyo mine. A mine-mouth market, such as a power generating plant, has not been nor is it likely to be proposed. If the Colowyo mine is not developed, beneficial as well as adverse impacts discussed in preceding sections of this site-specific analysis would not occur. Also adversely affected would be potential development of coal near the proposed railroad route and to the south where abundant coal occurs but where existing transportation facilities are inadequate for major development.

Alternate Routes

Several alternate routes for the railroad were considered; most were abandoned as having significantly greater adverse environmental impacts, largely because most other routes add considerably to the length of the railroad without compensating environmental advantages.

The two shortest alternate routes are presented for comparative analysis with the proposed route. These routes, designated B and C, are shown in Figure GRI-1. An impact analysis matrix was prepared for the

TABLE GRVIII-1

Analysis of Unmitigated Impacts for the Proposed Route and two Alternate Routes

	Proposed Route A	Alternate Route B	Alternate Route C
Geologic and Geographic Setting	-M	-L	-H
Mineral Resources	-0	-M	-L
Water Resources	-L	-0	-0
Air Quality	-L	-L	-L
Soils (Land Use)	-M	-H	-L
Terrestrial Flora	-M	-L	-H
Terrestrial Fauna			
Wild	-M	-L	-H
Domestic	-L	-L	-L
Aquatic Biology	-L	-0	-M
Archeological Resources	-M	-L	-M
Historical Resources	-M	-M	-M
Aesthetics	-M	-L	-H
Recreation	-H	-H	-L
Social Environment	-L	-L	-L
Economic Conditions	+L	+L	+L
Transportation Networks	+H	+H	+H

O - Negligible Impact
L - Low Impact
M - Medium Impact

H - High Impact
+ - Beneficial Impact
- - Minus Impact

proposed route and the alternate route, Table GRVIII-1. The net residual impacts of the individual routes were analyzed and rated in accordance to the lettering system shown on the table on the preceding page.

Geographic Setting

Route B begins just east of Route A, along the same steep bluffs overlooking the Yampa River, at an elevation of 6,260 feet. It crosses the Yampa on a 100-foot high bridge at 6,230 feet and continues westward at this elevation about two miles. Then it climbs a 1.5 percent grade to an elevation of 6,348 feet through a 40-foot cut at the county road crossing in NE 1/4 Section 13, T.6N., R.92W. From here it drops southwest down Bell Rock Gulch at a one percent grade to 6,185 feet near the lower end of the gulch, turns west through a 40-foot cut just west of a small reservoir in the gulch, and enters Yampa River valley at about 6,140 feet. The line descends to 6,130 feet and follows the west and north side of the Yampa for about four miles. The slopes above this part of the route are not excessively steep except in Sections 5 and 8, T.5N., R.92W., where the 600-foot high northern valley side includes slopes of as much as 100 percent above the route. The route then turns south to cross a 65-foot bridge over the Yampa at an elevation of 6,130 feet into Milk Creek Canyon (Figure GRVIII-1); from here on it coincides with Route A.

Route C is identical with Route A from the north end south to the Yampa-Williams Fork River confluence. Here Route C crosses the Williams Fork on a 20-foot high bridge at 6,130 feet elevation, then continues

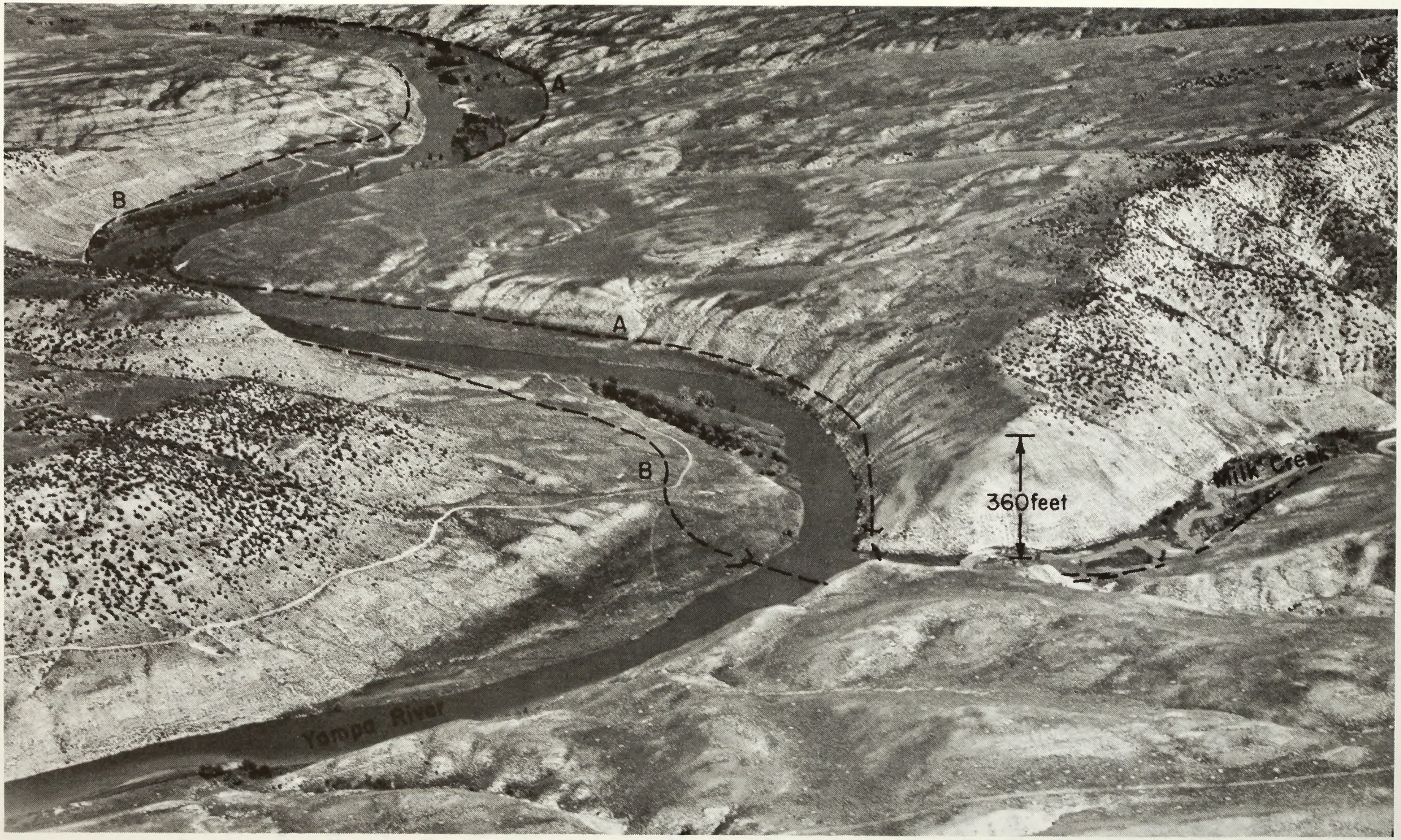


FIGURE GRVIII-1

Aerial oblique view east, showing Routes A and B along the Yampa River and the lower Milk Creek canyon. Route A requires a bridge over Milk Creek and Route B a bridge over the Yampa. Scale shown by hill at canyon mouth.

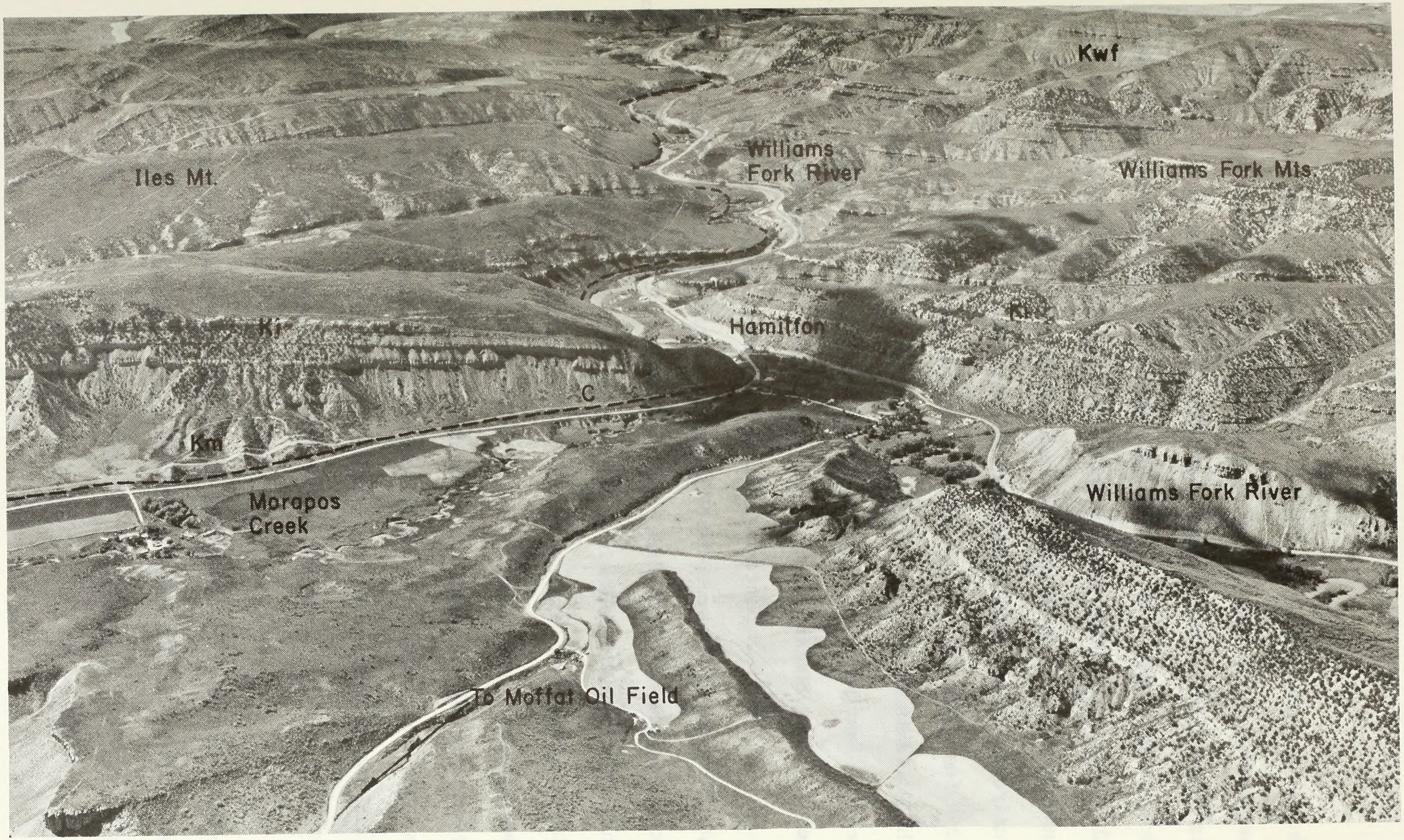


FIGURE GRVIII-2

Aerial oblique photograph with view northwest, showing Route C where it emerges from the Williams Fork River valley at Hamilton and enters the Axial Basin along Morapos Creek. (Km, Mancos Shale; Ki, Iles Formation and Knf, Williams Fork Formation).

southward up the west side of this river. It ascends at a grade of 0.2-0.8 percent to the small town of Hamilton; in this six mile stretch the Williams Fork River would be rechanneled in five places. The most extensive of these would be a 2,000-foot segment in S 1/2 S 1/2 NE 1/4 and N 1/2 SE 1/4 Section 7; T.5N., R.91W.; here the river would be moved eastward away from a steep hillside (about 65 percent slope) to allow room for the railroad. Other rechanneling segments are about 1,000, 900, 450, and 250 feet long; all are to allow the railroad to remain west of the river. The Williams Fork River flows in a narrow canyon that ranges from about 400-1,000 feet wide at the bottom, and has fairly steep sides which rise about 400-800 feet above the valley floor. At Hamilton the route ascends on a 1.5 percent grade through three deep rock cuts of 55, 70, and 90 feet. It leaves the Williams Fork River valley at about 6,370 feet and ascends Morapos Creek valley (Figure GRVIII-2) on a 1.1 percent grade. Then it enters Axial Basin at 6,520 feet over the low divide between the Williams Fork River and Milk Creek drainages. Running due west for six miles along the south foot of Iles Mountain, Route C descends on a one percent grade to curve northwest around the end of the mountain, then cross a 40-foot bridge over Milk Creek at 6,230 feet. Here it curves south to coincide with Routes A and B.

Geologic Setting

Route B begins westward along the south flank of the Craig Anticline on uppermost beds of the Williams Fork Formation, crosses the Yampa River, and continues west on Lewis Shale. In S 1/2 Section 7, T.6N., R.91W. the route crosses the axis of the Big Bottom Syncline and turns southwest on the south flank of the syncline, staying in the Lewis Shale for about two miles further as it starts south in Bell Rock Gulch. In this gulch the route traverses the upper beds of the Williams Fork Formation in crossing the Williams Fork Anticline. Beyond this gulch, the route is on alluvium in Round Bottom as it crosses the axis of Round Bottom Syncline. It then traverses gently dipping beds of the Williams Fork Formation on the west flank of Round Bottom Syncline as it follows the Yampa River's north bank to the mouth of the Milk Creek canyon; here Route B joins Route A.

Route C separates from Route A at the confluence of the Yampa and Williams Fork Rivers, and in its course up the Williams Fork runs parallel to and about one mile east of the axis of the Williams Fork Anticline. The first 1 1/2 miles has the Williams Fork Formation for bedrock, but from that point up to about one mile from Hamilton, the Iles Formation forms the bedrock along the river and canyon sides. Near Hamilton, the sandy upper part of the Mancos Shale forms the bedrock. As this route turns southwest up Morapos Creek it crosses the axis of the Williams Fork Anticline near center west line Section 28, T.5N., R.91W., and one mile west, the axis of Round Bottom Syncline. Westward along the foot of Iles Mountain, the route runs along the strike of the Mancos Shale on the north flank of the Axial Basin Anticline to join Routes A and B at Milk Creek.

Paleontology

Alternate routes B and C traverse the same four formations as the proposed Route A: Mancos shale, Iles Formation, Williams Fork Formation and the Lewis shale. Impacts to fossils would vary in relation to relative lengths of the routes traversing each formation. No specific fossil localities have been found.

Water Resources

Ground water

The most important impact related to ground water would be slope instability in cuts that intercept the water table. This could be a serious problem at the summit of Route B where a 40-foot cut would be required; this cut would be in the Lewis Shale which is the formation most likely to cause problems. Deeper cuts would be required in other places but the summit cut on Route B would be the only place where the cuts would be likely to intercept the water table. Existing ten percent slopes in this area are stable, and presumably if the slopes of the cut would be flat enough, this cut could also be stabilized.

Surface water

The sediment yield from both Routes B and C would be less than for Route A. Route B would not infringe upon the Yampa River as Route A does, but it would require the same rechannelization of Milk Creek. Route C also would not infringe upon the Yampa River nor would it require rechannelization of Milk Creek; however it would require rechannelization of the larger Williams Fork River.

Soils

Route B would affect more private landowners and disturb more acres in grain production than Routes A and C. In addition, since more cropland is involved along this route, there would be a greater possibility that more farming operations would be disrupted by the railroad severing portions of fields. These disruptions mainly would be problems of getting farm equipment into the severed farm tracts, which might result in building additional access roads with increased losses of cropland.

Terrestrial Flora

Segment 2 (see Figure GRII 2): Colorado Ute spur to Bell Rock Gulch

Starting at the same point as Segment 1, this portion of Route B approaches Milk Creek through Bell Rock Gulch. Topography and land use are the dominating factors in the plant ecosystems along this route. Sagebrush, riparian, and agricultural lands are the only existing plant communities. The majority of agricultural lands are devoted to wheat production. Like other areas within this region, sagebrush rangelands are used for livestock grazing.

Segment 4: Yampa/Williams Fork to Hamilton

Plant communities along this portion of Route C are similar to other areas along the other proposed corridors. Cultivated lands are not a prominent feature because of the steeper topography. Oak woodland is well developed on moist east and north-facing slopes; pinyon and juniper stands develop along the rocky outcrops of the ridge lines. Cottonwoods and other riparian vegetation exist along the Williams Fork floodplain for the entire length of this segment.

Segment 5: Hamilton to Milk Creek

This segment of Route C generally follows Highway 13 along the flanks of Iles Mountain. Pinyon-juniper, oakbrush, and sagebrush communities occur across the top and down the side slopes of this mountain. Hay fields occur along the highway where topography permits farming. Greasewood is also present throughout this portion of Route C in areas with a higher water table.

Terrestrial Fauna

Wild fauna

Route B

This alternate route would result in light impacts to the majority of wildlife species because a greater percent of the route would be constructed through previously disturbed areas, primarily cropland. Only 94 acres of riparian habitat would be impacted by this route which would be a minimal amount in relation to the other two routes.

Route C

This route would result in the most significant impacts of the three because of the amount of riparian habitat impacted.

Domestic fauna

Of the three routes, Route A would result in the loss of approximately 75 AUMs, Route B about 69 AUMs, and Route C about 84 AUMs. The impacts of fencing would be more restrictive along Routes A and C.

No major livestock use areas would be seriously impacted by any of these three routes.

Aquatic Biology

Route B

The impacts on the aquatic community which would result from the construction of Route B would be similar to Route A. However, the impact on the valuable endangered species habitat in the Yampa River would be less if Route B were constructed.

The construction of Route B would require significantly fewer rock cuts and stream bed fills along the Yampa River than the construction of Route A. Route B would be constructed well west of the Yampa River along Bell Rock Gulch, not affecting the river again until its crossing at the mouth of Milk Creek. The impacts of Route B along Bell Rock Gulch would be minimal since the drainage only carries water during spring runoff or heavy summer thunderstorms; thus it is doubtful that sediment resulting from construction along Bell Rock Gulch would reach the Yampa River, even if extensive channel realinement would occur.

The remainder of Route B would be common with Route A from the mouth of Milk Creek to the loading facility in Taylor Creek Canyon; impacts to Milk Creek would be the same for the southern portion of Route B as those stated for Route A.

Route C

The major impact of Route C would occur along the Williams Fork River. The only known study of the Williams Fork River was conducted by the Colorado DOW in 1972 for the proposed construction of Highway 13 along the river; it necessitated channelization of the stream in some areas. Species collected on the Williams Fork, and their relative abundance, are also shown in Table GRII-5. The study team concluded that the river was in relatively poor condition as a result of varying degrees of pollution; however aquatic organisms indicative of improved water conditions were present, and it was believed that the biological capacity of the stream was increasing. This section of the river was and still is considered a marginal fishery, but it retains the potential for improvement if pollution (such as siltation) is controlled. Data collected indicate a very low rainbow trout population; mountain whitefish are the most common fish in this segment of Williams Fork.

Rainbow trout is the only species stocked in the stream; other species survive through natural recruitment. Age class distribution and growth vary depending on the species. Data collected indicate several age classes in most species, but no work has been done on growth rates; detailed data are not available on pressure or harvests. Some stocking occurs in the area and most of these fish probably are harvested. Fishing pressure is regulated by private land that limits access.

Necessary stream channel realinements along the Williams Fork would increase the sediment load in the Yampa River below the confluence of the two rivers. The aquatic community of the Williams Fork River would be significantly affected by the construction of Route C; alterations of the natural channel of the Williams Fork would result in the elimination of many aquatic organisms due to increased siltation in riffle areas, increased rate of stream flow, and habitat destruction. It is likely that most fishes present could escape the habitat disruption by migrating into the Yampa River; however, most members of the benthis invertebrate, periphyton, and plankton communities would be destroyed. Total recovery of the aquatic community resulting from channelization of the Williams Fork would require several years.

Archeological Resources

Route B

Specific impacts that would result if Route B were constructed are shown in Table GRIII-5. Site numbers refer to sites depicted on Figure GRII-9. All sites would be exposed to vandalism and pothunting; ten lithic sites are subject to complete physical displacement; three lithic sites and one rockshelter are subject to partial displacement. Mitigating measures would be similar to those for the proposed route.

Route C

Table GRIII-5 also reveals probable site specific impacts on archeological values due to Route C's construction. Twenty-two lithic sites, four chipping sites, and one campsite are subject to complete displacement; four lithic sites, one chipping site, and two pictographs are subject to partial displacement. All sites would be subject to vandalism and pothunting. Mitigating measures also would be similar to those for proposed Route A.

Historical Resources

Route B

See Table GRIII-5 for Route B's impact on historical resources. Three sites with buildings would be impacted, subject to complete displacement.

Route C

Site specific impacts for historical values are also depicted on Table GRIII-5. Five sites with buildings would be impacted, subject to complete physical displacement.

Realinement of Routes A, B or C

A minor realinement of the segment shared in common by all three routes (SW 1/4, Section 30, T.5N., R.92W.) would allow the railroad to bypass the George Iles ranch. This would mitigate adverse impacts to the site. However, impacts to mood-atmosphere values of the site, both audio and visual, would be unavoidable due to the close proximity of the railroad.

Route B

The visibility of Route B from its southern terminus to Round Bottom on Yampa River is the same as described under Route A; both routes would coincide along this portion of the route.

Seven figures have been prepared which illustrate key points along Route B's alinement; see figures GRVIII-3 through GRVIII-9.

Foreground landscapes visible from viewshed sequences UV and VW on Colorado Highway 13 (see Figure GRII-12) contain especially visible portions of Route B as well as Route A. Sequence XW provides the greatest number of viewshed sequences from which to view foreground landscapes containing Route B. Viewshed sequences DE, EF, HI, IJ, JK, KL, LM, MN, and OP provide foreground access to proposed Route B. Minus deviations in these landscapes are few; significant exceptions include the electric transmission line visible from sequences LM, MN, and OP. The landscape of County Road 30 is characterized by strongly form-dominant, rolling sagebrush landscapes containing intermittent line-dominant, agricultural lands -- largely grainfields plus irrigated meadowland in the Big Bottom area (see Figures GRVIII-4 through GRVIII-8).

Middleground views of Route B approximately one-half mile west of the proposed Yampa River crossing are available from viewshed sequence QR on U.S. 40. Viewshed sequence ST on Colorado 13 also provides southbound motorists with middleground views of the beginning segment of Route B. Middleground landscapes containing Route B lie immediately west of the

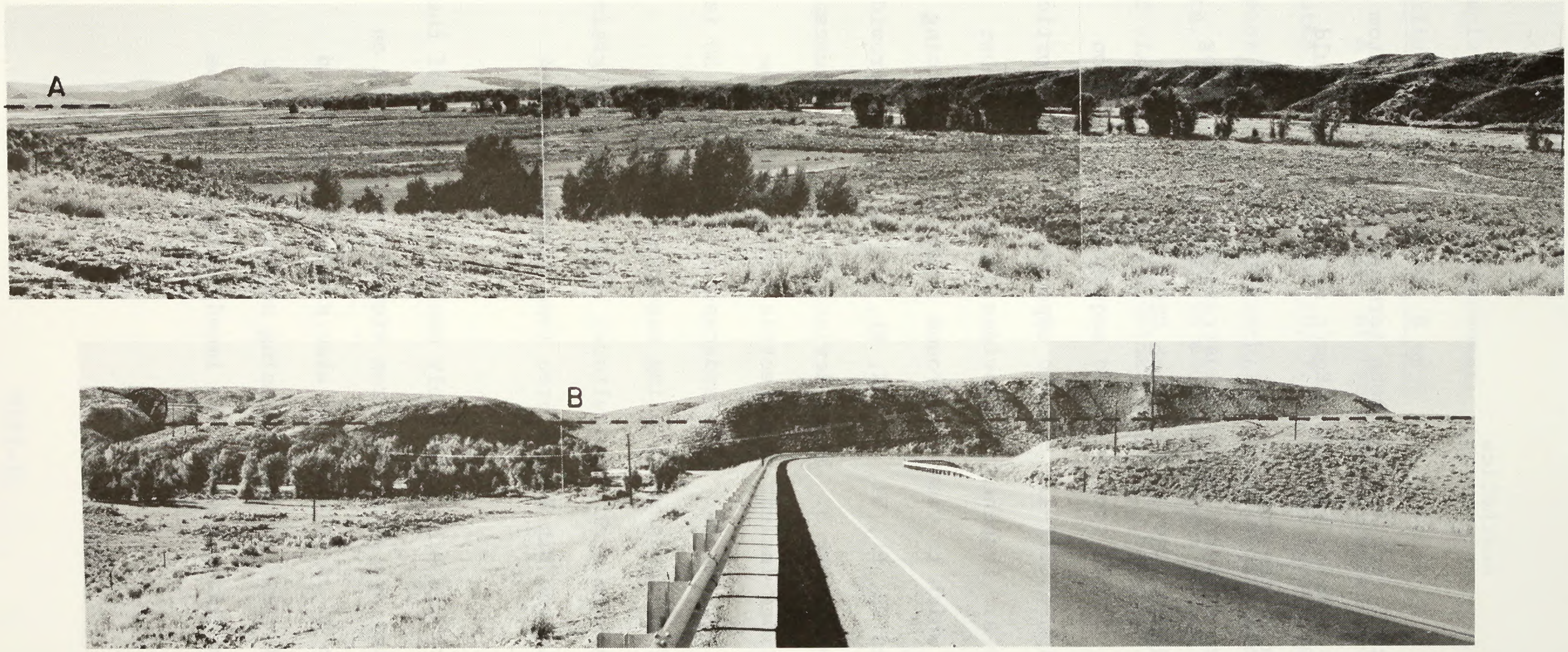


FIGURE GRVIII-3

Looking west on viewshed sequence VW from Colorado 13 one can see Big Bottom (above) and the alternate Route B crossing of the Yampa River and the crossing of Colorado Highway 13 approximately in-line with the existing transmission line (see lower photo); an 85 foot deep cut would be made through the hill on the horizon (right-hand corner of top photo).

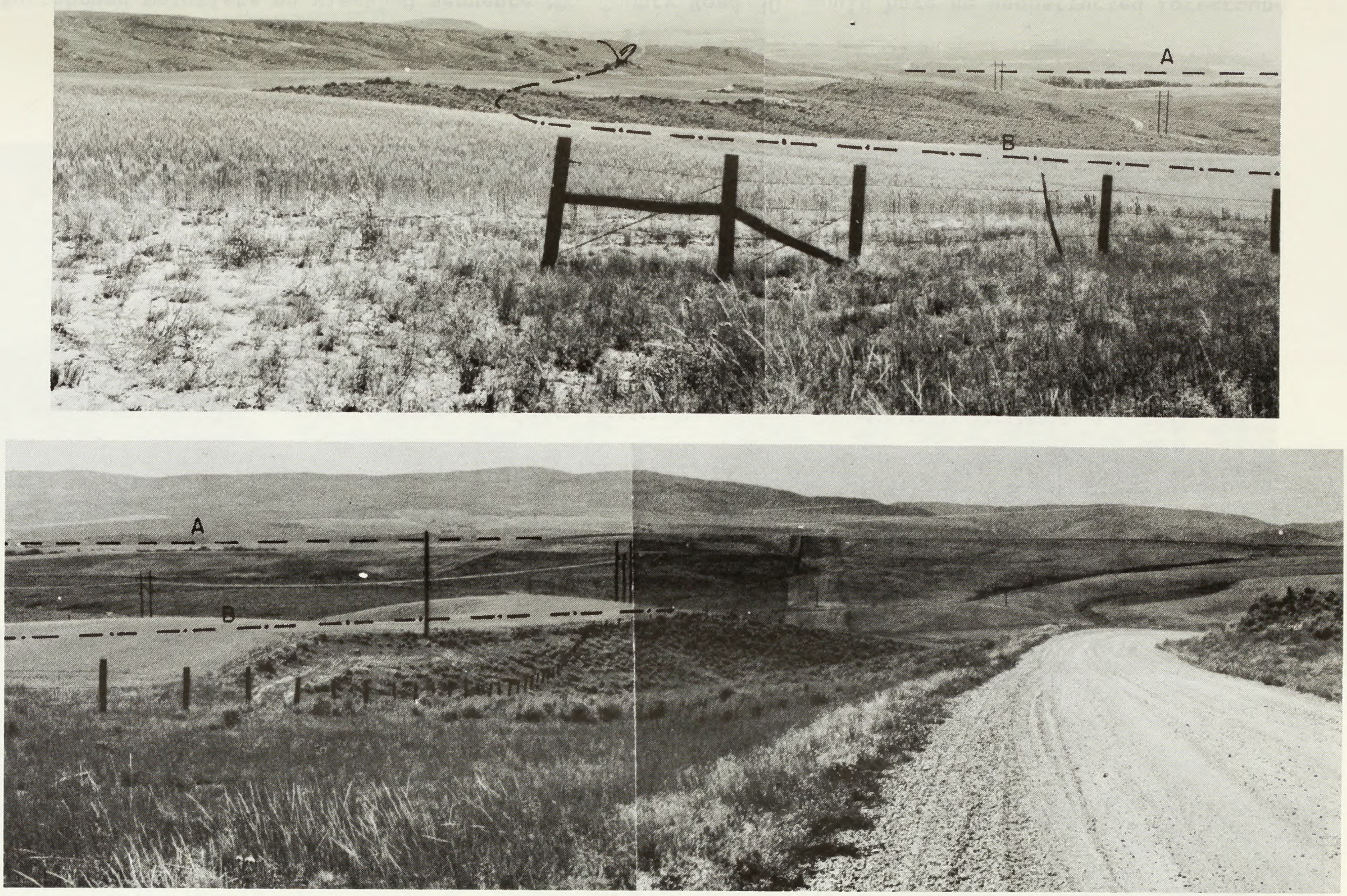


FIGURE GRVIII-4

Viewshed sequence MN on County Road 30 provides southbound motorists with this panoramic view. An 85 foot deep cut would be visible in the middleground (see center of top photo) if alternate Route B were constructed.

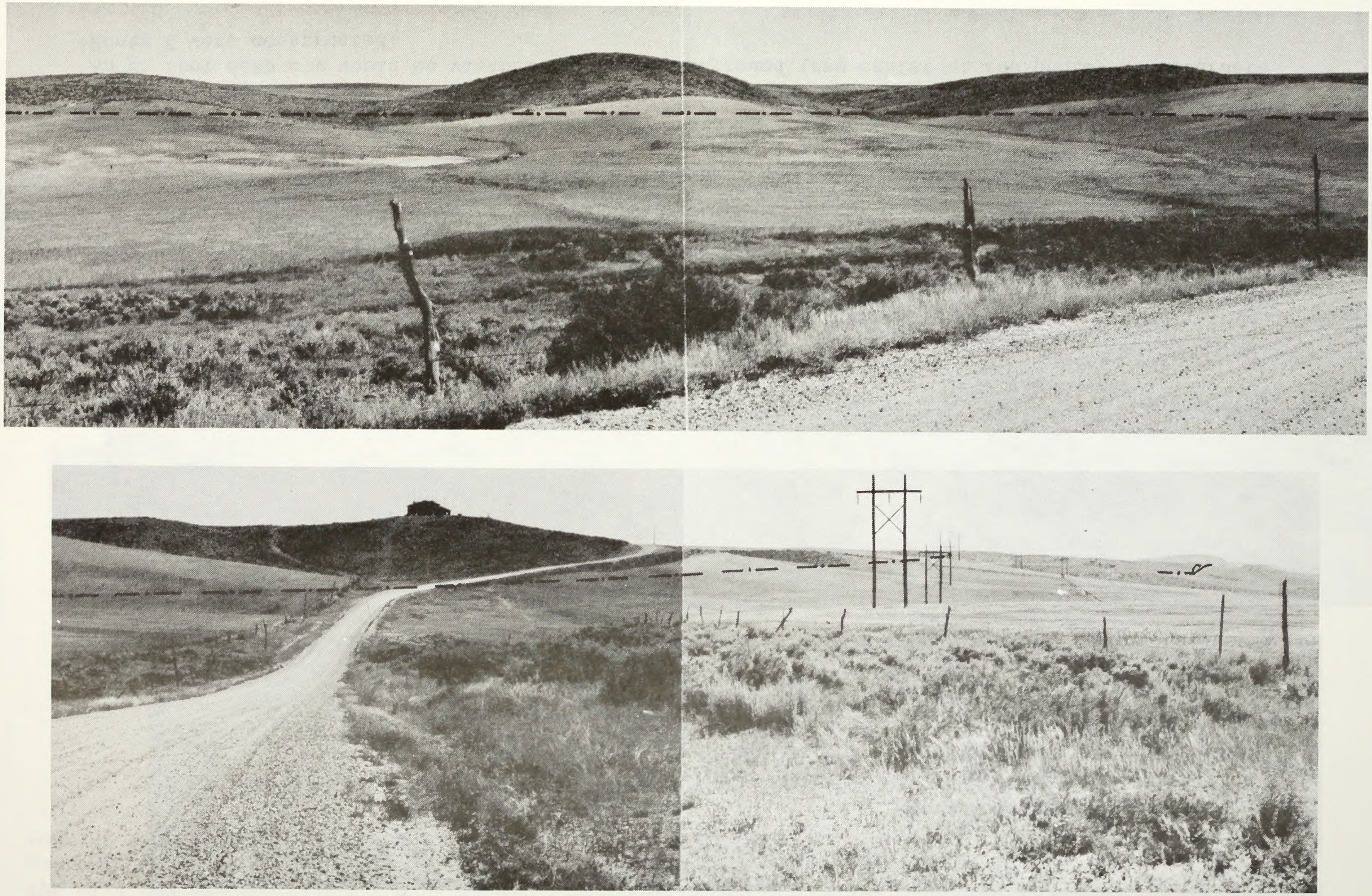


FIGURE GRVIII-5

Northbound motorists on viewshed sequence MN, County Road 30, would have an unobstructed foreground view of alternate Route B as it crosses this agricultural landscape.

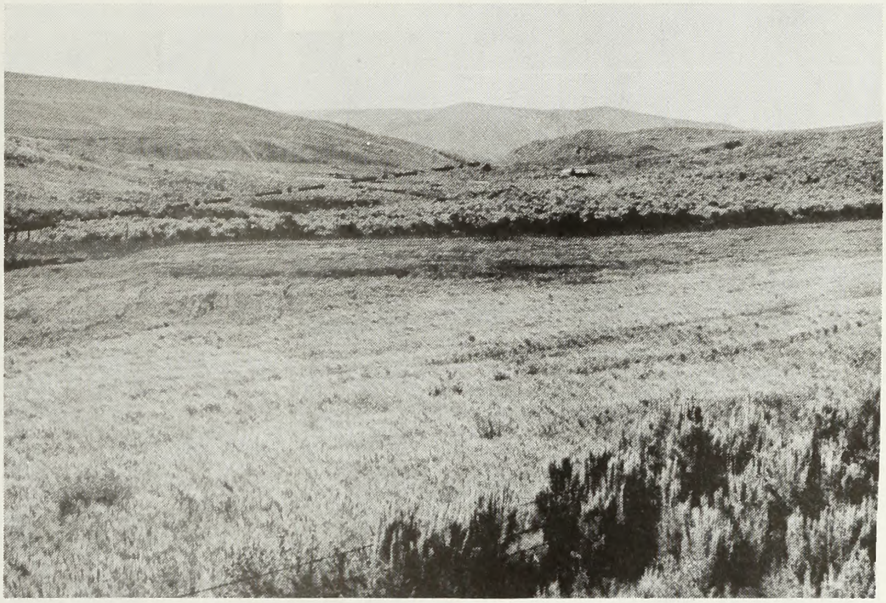


FIGURE GRVIII-6

Only a small portion of alternate Route B through Bell Rock Gulch would be seen from public roads. Viewshed sequence IJ would provide visual access to southbound motorists along this portion of the route as seen from County Road 30.

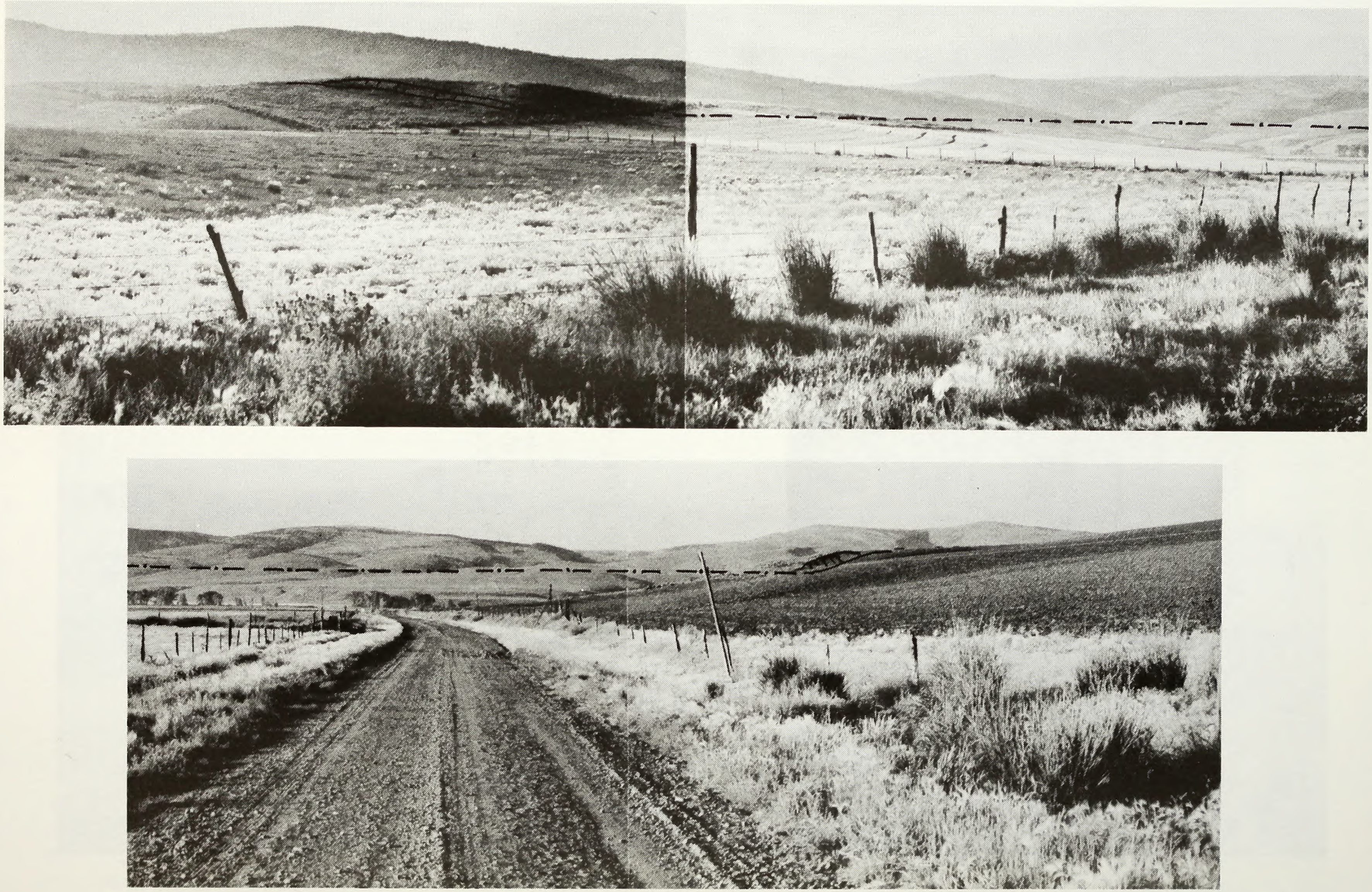


FIGURE GRVIII-7

This four-photo panorama shows alternate Route B's crossing of County Road 30 (lower photo) as seen from viewshed sequence EF; this would result in a 45 Foot high fill. The foreground ridge on the left-hand side of the upper photo also would be cut 40 feet deep by Route B.

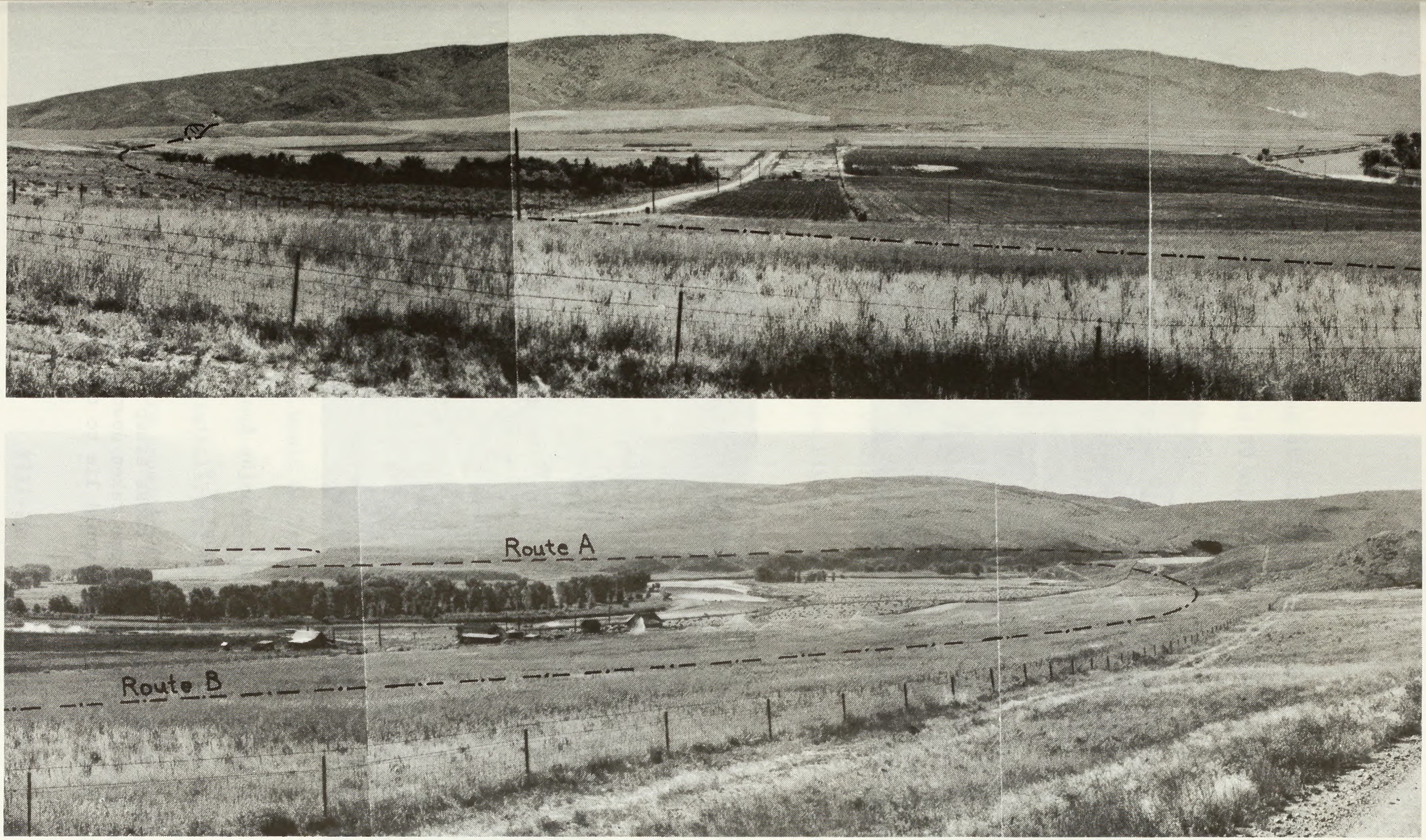
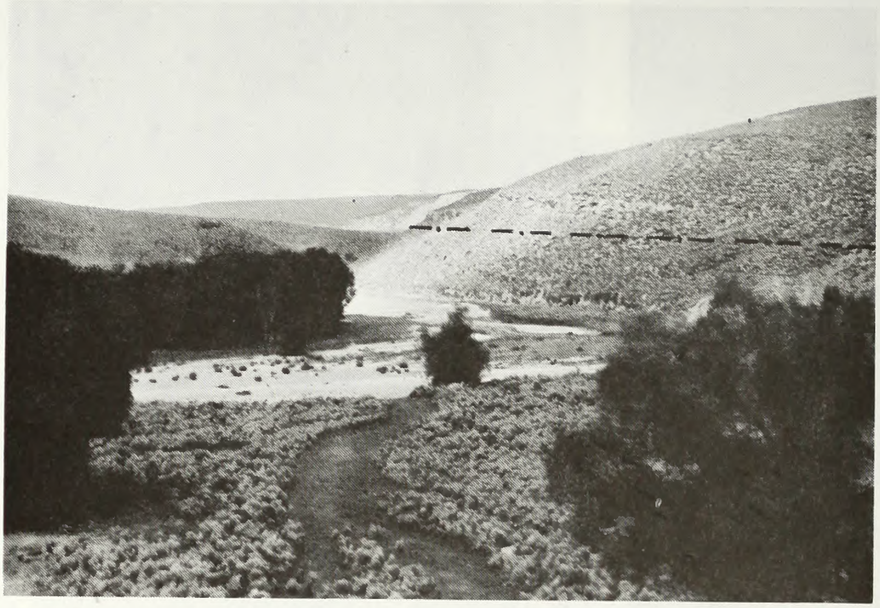


FIGURE GRVIII-8

This five-shot panorama can be seen from County Road 30 on viewshed sequence DE. The left-hand portion of the lower photo reveals the alinement of Route A across the steep hillsides shown in Figure GRII-22. Both Route A and Route B alinements can be seen in this landscape visual unit.



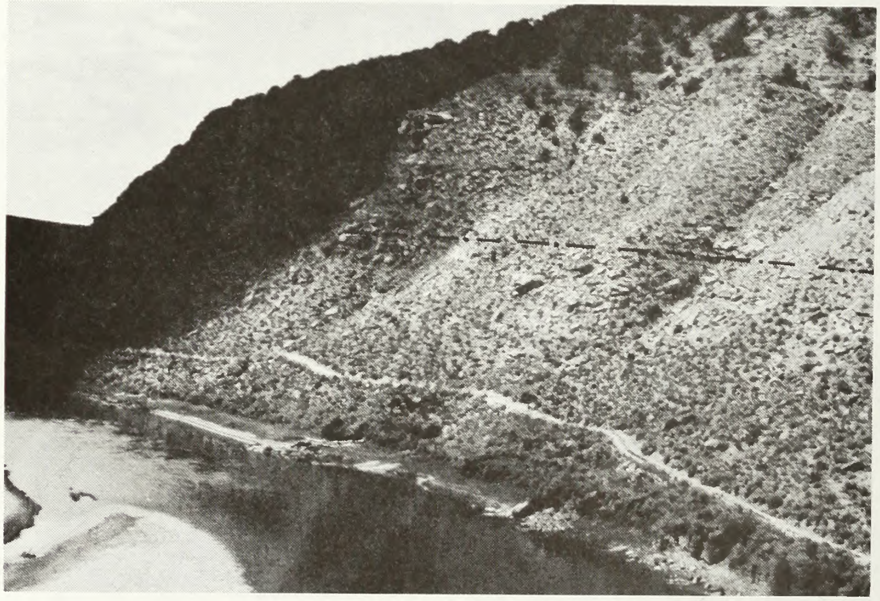


FIGURE GRVIII-9

Alternate Route B would also cross steep hillsides in Little Yampa Canyon. Both photos were taken downstream (looking west); Route B's alinement would lie to the right of the river.

proposed Yampa River crossing at Big Bottom and can be viewed from viewshed sequences on both County Road 30 and Colorado Highway 13 (see Figure GRII-12). The northern end of Bell Rock Gulch contains middleground landscapes that can be viewed from sequence IJ on County Road 30 (see Figure GRVIII-6); about one mile of Route B will not be visible on the southern end of Bell Rock Gulch. No background landscape visual units occur along Route B.

Additional foreground landscapes along Route B would also be created by construction of the proposed Juniper Reservoir. Potential recreational boaters would have continual visual access to the route for about five miles on approximately five viewshed sequences; the route would be visible from Round Bottom to the Yampa River's confluence with Milk Creek (see Figure GRVIII-9).

Impacts resulting from Route B would differ from those on Route A in both geographic location and magnitude. Impacts of this route would include two additional bridges over the Yampa River: one in the foreground at viewshed sequence VW on Highway 13, and the other would be visible as middleground at the Milk Creek-Yampa River confluence. It also would entail a higher bridge over Highway 13, 50 feet as opposed to 20 feet for Route A. Bridge heights over the Yampa River would be 100 feet at viewshed sequence VW north of Big Bottom, and 65 feet at the Milk Creek confluence. Route A's 20 foot-high bridge over the Williams Fork River and the 65-foot high bridge over Milk Creek would no longer be needed.

Except for Highway 12 and adjacent Yampa River crossings at viewshed sequence VW, the relative visibility of Route B would be lower. Traffic volumes on County Road 20 are considerably less than on Colorado Highway 13 as it is a graveled dead-end road; local residents would constitute the bulk of this traffic (see Chapter II for traffic volumes on Highway 13).

Numbers and locations of adverse impacts resulting from especially visible cuts and fills are found in Table GRVIII-2; these can be related to those in Table GRIII-5 for Route A, to enable a comparison of these adverse impacts. Cuts and fills visible from roads would total 15 for Route A and 14 for Route B; cuts and fills visible from the proposed Juniper Reservoir would total 22 for Route A and 10 for Route B. Seven of the total cuts and fills on Route A might be viewed from both the potential reservoir and roads; this figure for Route B is four.

Mood-atmosphere values adversely impacted in the especially sensitive Little Yampa Canyon area would be about half as significant on Route B; it would traverse about five miles of the canyon compared to ten miles for Route A.

Route C

With the exception of viewshed sequence XZ, all sequences on Colorado 13 from UV (see Figure GRII-12), through BC (See Figure GRII-13), provide continuous visual access to foreground landscape visual units containing proposed Route C. Analysis of Landscape Visibility Maps reveal that overlapping viewsheds provide multiple foreground and middleground views of certain segments of this most visually sensitive portion of Route C. County Roads 41, 45, and 49 provide visual access, generally at middleground distances, to portions of Route C along the southern flank of Iles Mountain; these portions of the route are also visible as foreground visual units from Highway 13.

TABLE GRVIII-2

Route B -- Summary of Significant Cuts and Fills

Number	Landscape visual unit classification in which cut or fill occurs	Direction of view(s)	Cut or fill	Size (ft.) height or depth
1	fg UV & mg ST	S	Cut	80
2	fg UV & fg VW; mg VX, YZ	N, S & W	Fill	100
3	fg VW; mg VX, YZ & mgMN	N, E & W	Cut	95
4-5	fg OP mgWX, YZ,		Fill	60
	QR & fgMN, mgLM	N & S	Cut	50
6-7	fgMN, mgLM	E	Cut	30
			Fill	45
8	fgLM & fgMN	N	Cut	25
9	fgLM, mgMN	N & S	Cut	40
10	mgHI	S	Cut	30
11-12	fgEF & fgDE	N & S	Cut	40
			Fill	45
13	fgDE	N	Cut	30
		S	Fill	20

(The remaining cuts and fills listed below may be viewed by boaters on the proposed Juniper Reservoir)

Number		Landscape visual unit classification	Cut or fill	Size (ft.)
15	(Listed moving downstream)	mg	Cut	40
16		mg	Fill	45
17	(Same as Nos. 11-14 above)	fg/mg	Cut	30
18		fg/mg	Fill	30
19-20		fg/mg	2 Fills	30
21		fg/mg	Fill	30
22		fg/mg	Fill	25
23		fg/mg	Fill	30
24	(Bridge across Yampa River at Milk Creek)	fg/mg	Fill	65
25	(Along Milk Creek)	fg	Fill	30
26	(Along Milk Creek)	fg	Cut	45

SOURCE: W. R. Grace and Co., Feasibility Study for Coal Haul Railroad, October, 1974, prepared by Morrison-Knudsen Co. Inc.

A description of the southern portion of Route C is as described under Route A because all three routes coincide south of the confluence of Milk and Jubb Creeks. No background landscape visual units occupy Route C.

Six additional Figures, GRVIII-10 through GRVIII-15, have been prepared to show views at key points along alternate Route C. Figure GRVIII-2 is an aerial oblique photograph that shows Route C's alinement along the Williams Fork River.

Impacts resulting from Route C would differ from both Route A and Route B in their geographic location and magnitude. Impacts on that portion of the route north of the Williams Fork River crossing would be identical to those for Route A, as both routes coincide. The bridge across the Williams Fork River would be similar to that for Route A but in a slightly different location; both would be 20 feet high. Route A's 65-foot high bridge over Milk Creek would be replaced by a 45-foot high bridge at the head of Milk Creek Canyon; it would be visible in middleground landscape visual units from viewshed sequences IJ and KL on County Road 17.

The relative visibility of Route C would be considerably greater than than of Route A. Traffic volumes would be similar (See Chapter II), but a greater number of viewshed sequences (road segments) would offer views to Route C. Colorado Highway 13 as well as several county roads would provide visual access to this route (see Figures GRII-12 and GRII-13).

Numbers and locations of adverse impacts resulting from especially visible cuts and fills are found in Table GRVIII-3; these can be related to those in Table GRIII-6 for Route A for a comparison of adverse impacts. Total numbers of significant cuts and fills that would be visible from

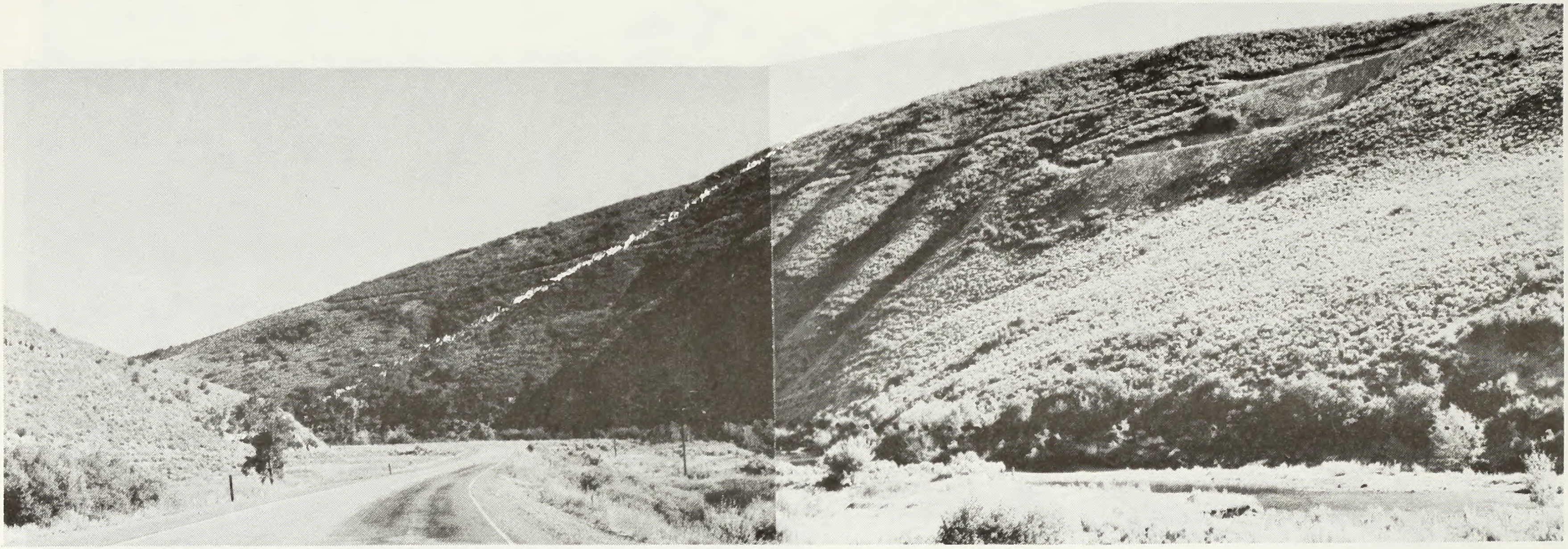


FIGURE GRVIII-10

Southbound on Colorado 13, the motorist looks directly ahead from viewshed sequence EF to the proposed alinement of alternate Route C and would encounter a 25 foot deep cut on the steep shadowed hillside.

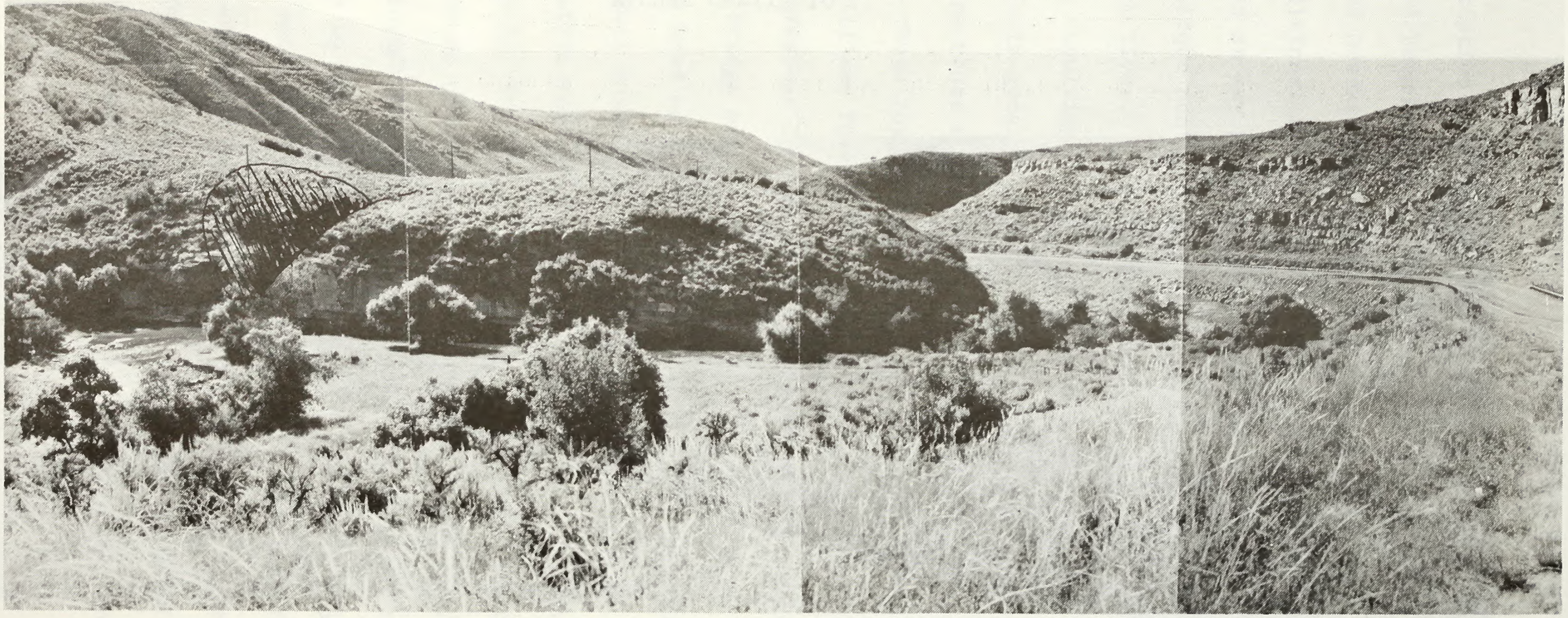


FIGURE GRVIII-11

A 60 foot deep cut would be made through the rounding foreground ridge (see center of photo sequence) if alternate Route C is constructed. This view is available to northbound motorists on viewshed sequence GH, Colorado 13.

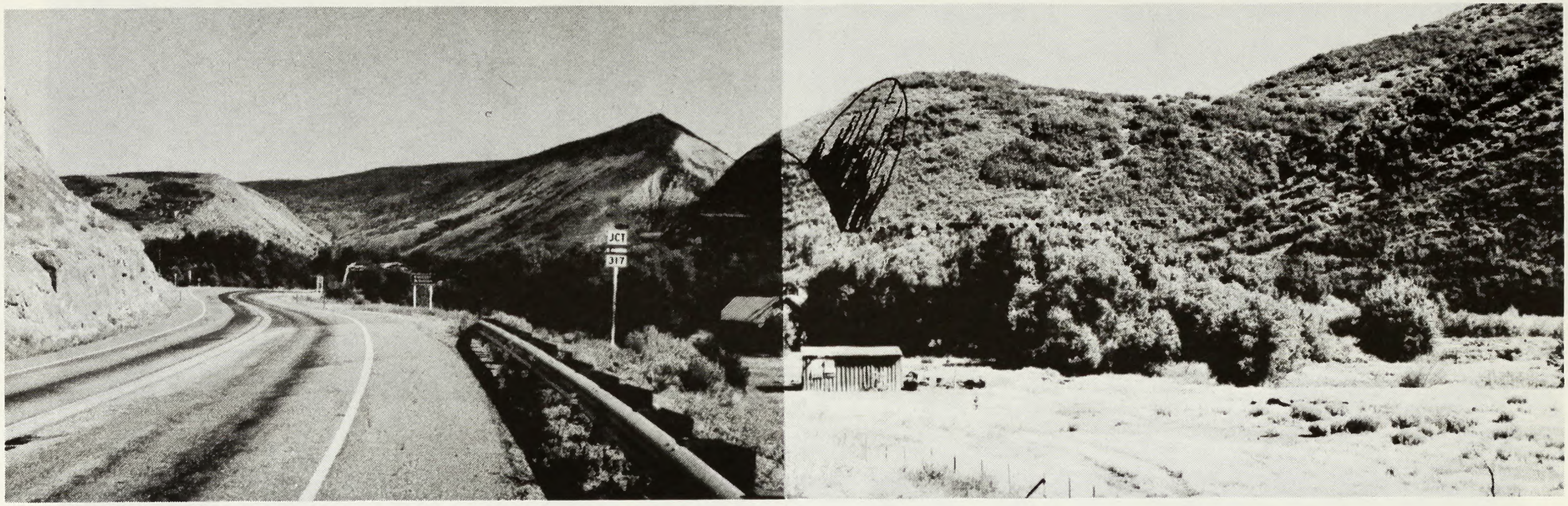
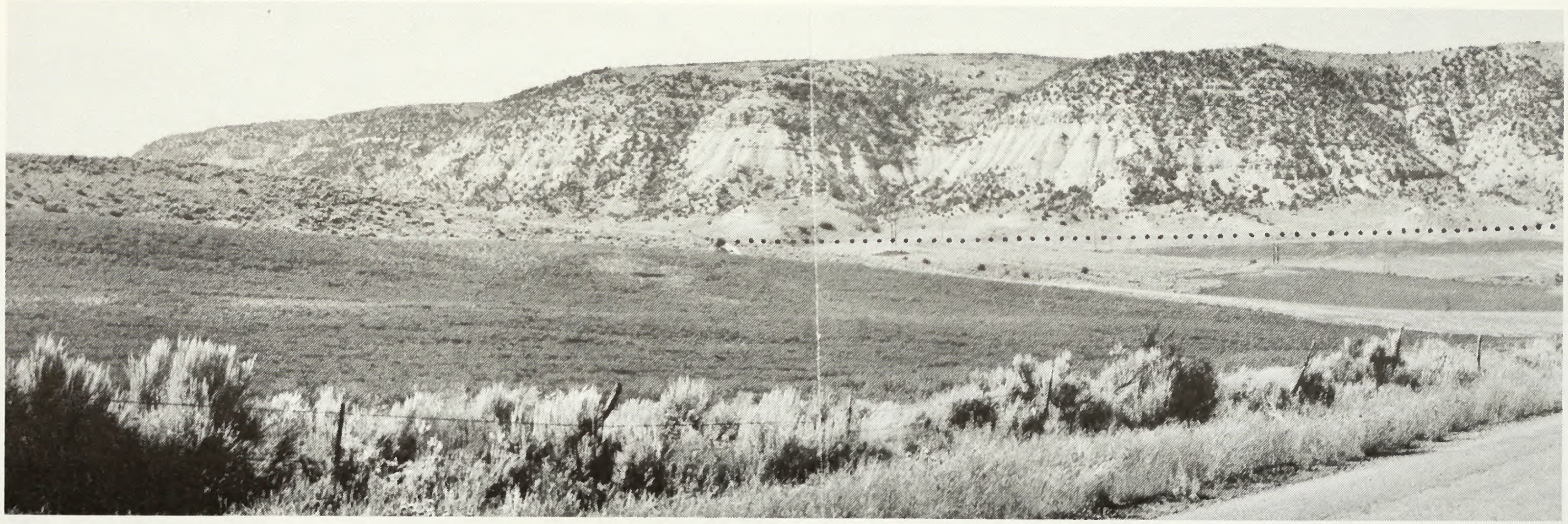


FIGURE GRVIII-12

A 90 foot deep cut would be made through the rounding hillside shown in the center of the photo if alternate Route C is constructed. This view appears southbound on Colorado 13 immediately north of Hamilton on viewshed sequence JK.



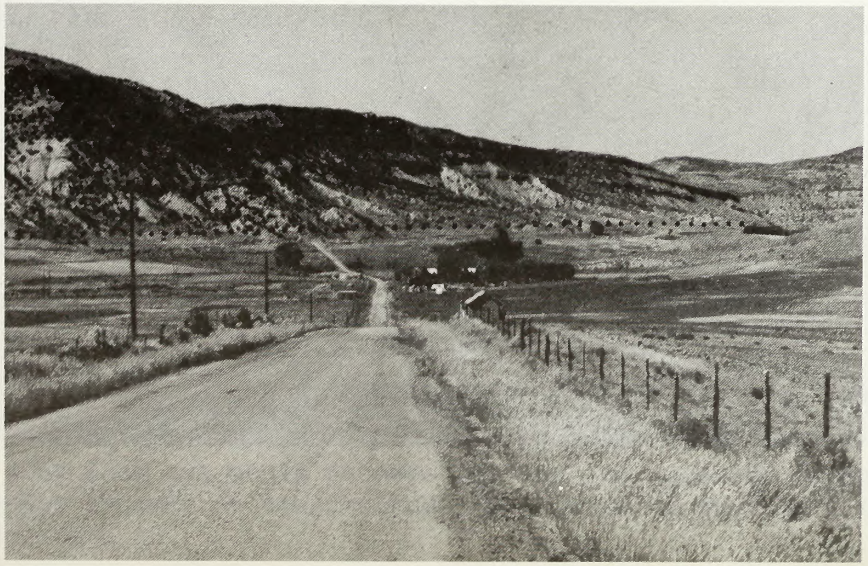


FIGURE GRVIII-13

Looking north from viewshed sequence NO on County Road 41, this three-shot sequence shows alternate Route C's alinement around the southeastern base of Iles Mountain. Several deep cuts would be visible on this railroad segment in the foreground distance zone from Colorado 13.

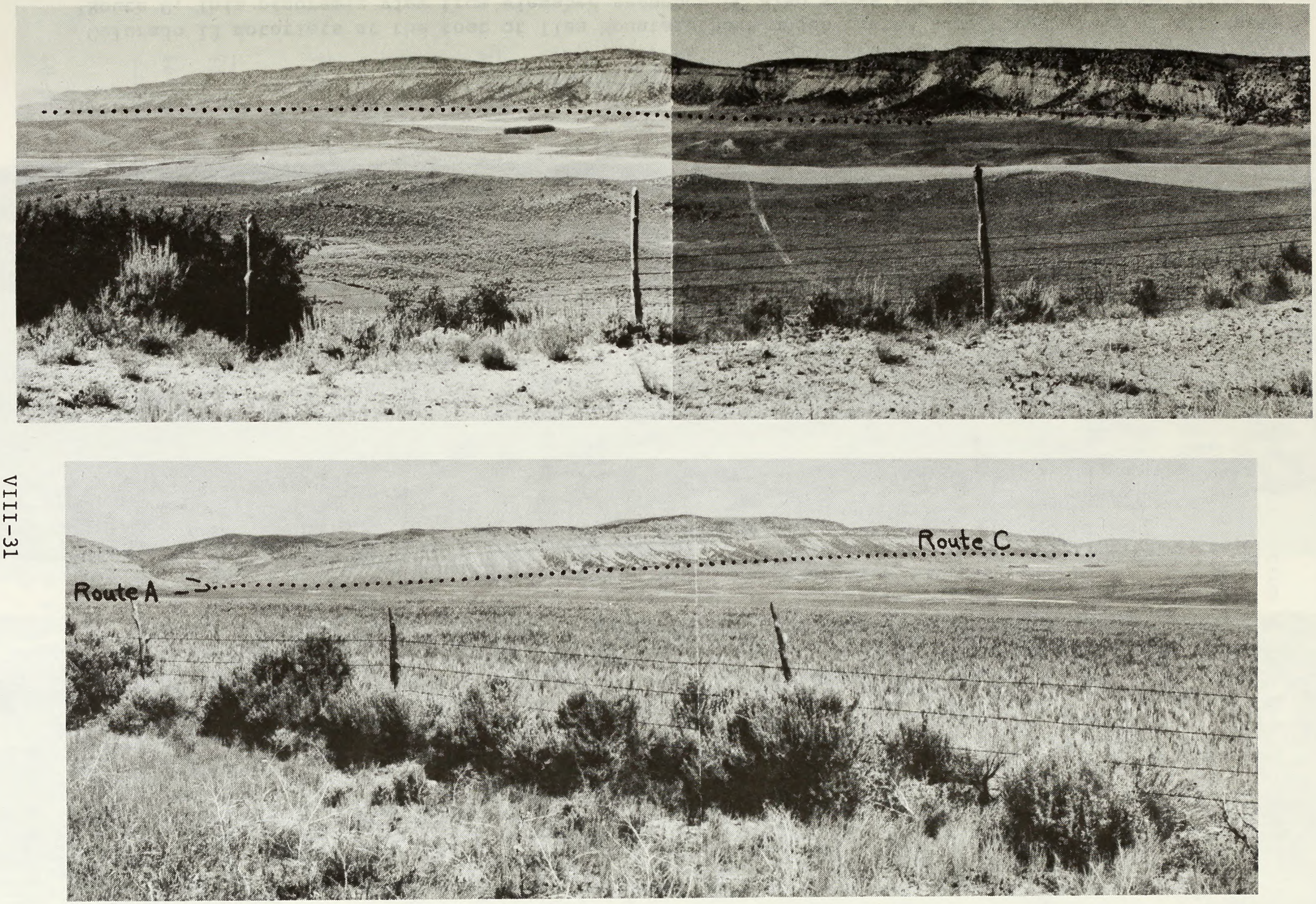


FIGURE GRVIII-14

Distant middleground views of Route C's alinement across the southern base of Iles Mountain are illustrated in these two separate panoramas. The top photo looks northwest from viewshed sequence PQ on County Road 41; the bottom photo looks northeast from viewshed sequence HI on County Road 17.

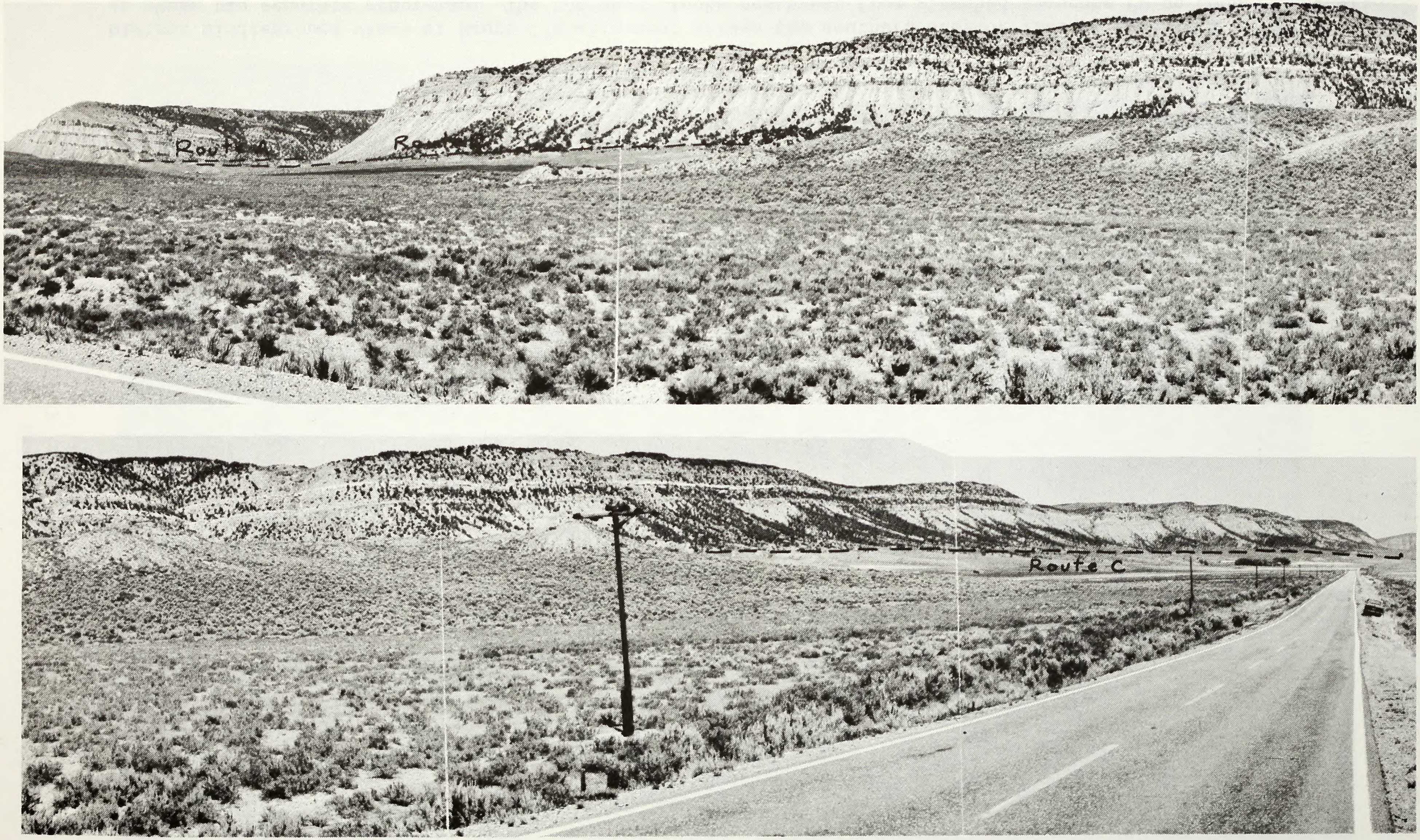


FIGURE GRVIII-15

Colorado 13 motorists at the foot of Iles Mountain have unobstructed foreground views of alternate Route C. This panoramic view from viewshed sequence BC also shows the area where proposed Route A would emerge from Milk Creek Canyon (left side, top photo).

TABLE GVIII-3

Route C -- Summary of Significant Cuts and Fills

Number	Landscape visual unit classification in which cut or fill occurs	Direction of view (s)	Cut of fill	Size (ft.) (height or depth)
1	fgUV & mg ST	S	Cut	80
2-4	fgVW	E	Fill	90
		W	Fill	75
		W	Fill	40
5	fgVW & fg/mgWX	N & S	Cut	50
6-8	fgWX	N & S	Fill	30
			Cut	40
			Cut	60
9	fg/mgAC	N & S	Cut	30
10	fgBC & fgCD	N & S	Cut	40
11	fgDE	N & S	Cut	30
12	fgDE & fgEF	N & S	Cut	50
13	fgEF	N & S	Cut	25
14	fgEF & fgEG	N & S	Cut	25
15	fgFG & fgGH	N & S	Cut	60
16	fgHI	N & S	Cut	40
17-18	fgHI 7fgIK	N & S	Cut	50
		N & S	Fill	40
19-21	fgIK	N & S	2 Cuts	55
			Fill	80
22	fg/mgIK	S	Cut	90
23-24	fgKL & fgLM, mgNO	N & S	2 Cuts	70
25	fgLM, mgNO & fgMN, mgNO	N & S	Cut	40
26	fgMN, mgNO	N & S	Fill	25
27-28	fgMN, mgNO & fgRN, NO; mgST	N & S	Cut	35
			Cut	
29-31	fgRN, NO; mgST	N & S	Fill	35
			Cut	25
			Fill	40
32	fgWRS, mgST	N,E & W	Fill	40
33-36	fgWRS, mgST & fgXW; mgXC YZ, IJ, KL	N,E & W	2 Cuts	65
			Cut	30
37-42	fgXW; mgXC, YZ,IJ,KL	N,E & W	3 Cuts	25
			2 Cuts	45
			2 Fills	30
			Fill	45
43	fgXY; mgWX, YZ, UV, YC, IJ, KL	N,E & W	Cut	25
44-48	fgYB; mgWY, UV, BC, IJ, KL	N,E & W	Cut	30
			2 Fills	30
			Cut	40
			Cut	55
			Cut	25
49-50	fgBC; mgIJ, KL, UV	N,E & W	Cut	25
	(Milk Creek Bridge)		Fill	45

SOURCE: W. R. Grace and Co., Feasibility Study for Coal Haul Railroad, October, 1974, prepared by Morrison-Knudsen Co. Inc.

roads total 15 for Route A and 50 for Route C; cuts and fills that would be visible from the proposed Juniper Reservoir total 22 for Route A and 0 for Route C.

Mood-atmosphere values adversely impacted by Route A in the especially sensitive Little Yampa Canyon area would not be impacted by Route C.

Recreation

Route B

Recreational impacts of Route B would be similar to those for Route A; significant differences follow:

No impacts would accrue to the sage grouse strutting ground adjacent to Big Bottom. Construction on very steep grades adjacent to Yampa River could be avoided in the first five miles of Little Yampa Canyon; commensurate reduction in siltation and subsequent impact reduction on fishing potential would result. Impacts to the natural values of the canyon would be half as great; Route B traverses only about five miles of the canyon, as opposed to ten miles for Route A. Impacts upon cultural resources between Round Bottom and Big Bottom could also be avoided. Mitigating measures for both routes are the same.

Route C

Recreational impacts of Route C would largely differ from those of Route A as follows:

No impacts to fishing potential in either Milk Creek or Yampa River would result from construction of Route C. There would be no impact on natural values in Little Yampa Canyon which Route A would traverse for ten miles. The Ellgen big game hunting area would not be impacted beneficially or adversely; however similar though less significant impacts might occur on the Camilletti big game hunting area (see Figure GRII-29). Cultural resources in the Little Yampa Canyon and Milk Creek Canyon would not be affected; other cultural resources adjacent to Iles Mountain and Colorado Highway 13 would be impacted instead (see Chapter VIII, History and Archeology). Other beneficial and adverse impacts listed for Route A would be similar for Route C.

Route C would also result in significant impacts on the fisheries in Williams Fork River as a result of siltation and sedimentation; four segments of the river proposed for rechannelization would compound these impacts. Mitigating measures for Route A would be the same for Route C.

Transportation Networks

Impacts of the alternate routes would be comparable to those of the proposed route. A table of right-of-way requirements for Route A is given in Chapter I of this site-specific; Tables GRVIII-4 and GRVIII-5 are for Routes B and C respectively.

TABLE GRVIII-4

Right-of-Way Requirements - Route B
(in acres)

Owner	Deeded Land	Leased Land		Juniper Reservoir Withdrawal	
		U.S. Government	State of Colorado	Private	Government
Raftopolis			27.1		27.1
Steele	8.3			8.3	
Vowles & White	15.5				
Earle	19.5				
Undetermined	17.7				
Silver	3.4				
Roberts	9.3				
Haxton	4.8				
Hilton	40.5	60.0		30.2	60.0
Zamboni[1]	1.1			1.1	
Conway	6.9			6.9	
Ellgen	44.4			44.4	
Gossard	39.4				
State of Colorado[2]			6.9		
Totals	211.1	60.0	34.0	90.9	87.1

[1] Hilton lease from Zamboni

[2] State of Colorado - unleased

Total Land Requirements for Route B = 305 Acres

TABLE GRVIII-5

Right-of-Way Requirements - Route C
(in acres)

		Leased Land		Juniper Reservoir Withdrawal	
Owner	Deeded Land	U.S. Government	State of Colorado	Private	Government
Raftopolis			5.0		5.0
Loudy	33.2		4.1		4.1
Evans			3.8		
Wilson Bros.	20.9			20.9	
Empire Energy	10.4		3.9	10.4	3.9
Jepkema	9.8				
Winn	32.0				
Charchalis	37.4	2.8		30.8	2.8
Mead	5.0	6.2			
Durkop	8.4				
Osborne Family	15.8				
Carpenter	23.8				
Osborne	10.2				
Rakestraw	15.5				
Loper	16.1	52.5	16.1		
Hilton	27.8				
Gossard	43.7				
Totals	310.0	61.5	32.9	62.1	15.8

Total Land Requirements for Route C = 405 Acres

Alternate Means of Transporting Coal

Truck Transportation

Colorado Highway 13 probably would not stand up to even two years of heavy coal hauling at under one million tons per year. With production of three million tons per year for the three benchmark dates of 1980, 1985, and 1900, use of this road for coal transport would require major reconstruction, maintenance, and adverse impacts on existing traffic. Even if an extremely heavy-duty road were constructed, traffic would be a truck every 5 or 6 minutes, 24 hours a day, every day of the year.

Slurry Pipeline

A coal slurry pipeline is a potential alternative to use of rail or truck transport of coal. A line is described in Chapter IX of the Regional Analysis; it could easily handle the three million tons per year production of the Colowyo mine. If the slurry pipeline were used only for transport to the railhead (the distance of the proposed coal-haul rail line) no pumping stations would be needed along the right-of-way. Slurry pits along the right-of-way would be required for draining the line in case of stoppage. Preparation stations would be needed at each end. Impacts of the buried pipeline itself would be small.

Use of water is the basic problem with a coal slurry pipeline. Since it takes about one ton of water to move one ton of coal, large amounts of water would have to be supplied to W. R. Grace (probably from the Axial basin area) and subsequently disposed of at the terminus of the pipeline. Effects on the existing ground water system in the Axial Basin area would be adverse, but the degree of importance cannot be forecast.

Another disadvantage of this transportation method is the high potential for freeze-up in northwestern Colorado during long, cold winters. During all seasons, the possibility of a pipeline break or leakage exists. As the line would cross underneath many small streams, there would be potential for water pollution. Any spillage or leakage into water courses would result in damage to aquatic life, aesthetics, and recreation values.

Conveyor Belts

Belt conveyors can be used as an alternative to rail or truck transport of coal. Technology is sufficiently advanced to assure sound construction of single or multiple flight belt conveyors for coal transport. They offer great design flexibility and economy where distance and quantity requirements are well known and are expected to remain relatively fixed. Long distance belt conveyors, however, never have been constructed. A 20-30 mile belt probably would require extensive design work.

In general, conveyor construction would cause impacts similar to railroad construction. A belt conveyor would be subject to belt lift by wind and would create quantities of coal dust downwind. To decrease dust, the entire length of the system would be hooded or guarded. This would add to the visibility of the structure and increase the impact on wildlife of the area. Power normally is supplied by electric motors located at frequent intervals along the line, requiring service roads, electric transmission lines, and other service facilities.

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